COAL AGE

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A GROUP of men who allow themselves to be called "efficiency engineers" have lately been making some of our Captains of Industry sit up and take notice.

They haven't seen fit to tackle the coal-mining industry as yet. But when they do, some of our friends who insist on thinking in circles will find themselves lost on a tangent.

There is nothing mysterious about the work of these experts. Anyone can anticipate many of their suggestions by simply adopting their method of digging into the whys and wherefores.

By way of illustration let us consider an average coking operation, supplied with coal from a mine producing mine-run that requires crushing and washing before it is suitable for the ovens. The chain of operations at such a plant is about as follows:

The coal is fed from the tip onto screens which usually separate the output into two sizes, lumps from $1\frac{1}{2}$ in. up, and fines from $1\frac{1}{2}$ in. down. The lumps are then fed to a crusher and reduced to $1\frac{1}{2}$ in. The material from the crusher and the fines from the screens are united in a boot underneath the crusher and the entire output is elevated to the storage bins above the washer jigs.

From these bins the coal is fed into jigs and, after being washed, the wet product is elevated to the coke-oven supply-bin from which it is run into the charging larries.

The history of this plant is probably about as follows:

The crusher and washer were installed about eight years ago. No elaborate tests were made on the coal at the time and none have been made since. Every one connected with the plant will tell you that before the washery was installed the coke was inferior and great difficulty was experienced in marketing it; however, every one brags about the product now and the output is easily disposed of. Looks like sacrilege to go behind such facts, don't it?

Now for the whys and wherefores:

First. Does the lump coal require washing? Sometimes it does, but often analyses demonstrate that the lump coal is not improved by washing. In such cases, simply crushing the lump, cuts down the cost of treating the coal one-half.

Second. Do *all* of the screenings require washing? Generally they do, but in some instances most of the impurities are found in the $\frac{3}{4}$- to $1\frac{1}{2}$-in. size, and in others from $\frac{3}{4}$-in. down. Here again there is a chance for cutting down the amount of material handled by the washery.

Third. Is the crusher suitable for the kind of coal it is handling and the washery that it feeds? There are several varieties of crushers: One type may pulverize a coal to a powder, while another kind may reduce it to 1-in., minimum size. Some fuels show a large loss in washing when crushed too fine, and in others the reverse is true. There is room for numberless tests here.

Fourth. Are the washer jigs being crowded? Some jigs produce best results on certain coals when working to their full capacity. Thus shutting down some of the jigs and crowding the balance may effect a remarkable improvement, while in other cases just the reverse treatment may be required.

Fifth. Is the percentage of waste coal in the refuse about right? Here is offered an opportunity for numerous experiments. It is possible to waste too much coal in the refuse and it is also possible to leave too much waste in the washed product; nor is the happy mean always the proper criterion. It is simply a matter of dollars and cents. Is a smaller quantity of a superior quality worth more than a larger quantity of an inferior quality?

Questions similar to the above might be tabulated to cover all of the different operations incident to mining and marketing coal; then intelligent solutions will often produce almost unbelievable results.

MORAL. Beat the efficiency engineers to it.

[*This foreword was written by an Alabama engineer.*]

Set Your House in Order

By Eli T. Conner

The excellent work of many coal-mining companies along sociological and first-aid lines, which have been so well described in the pages of Coal Age during the past year, afford a good index of the growing conviction of progressive operators that they owe a higher duty to their employees than merely paying the agreed wages for work performed.

The interest of the operator in the employee rightly extends to his family, also; and it is pleasing to note that this interest is growing, rapidly, as is evidenced by the provision, on the part of many companies, of attractive and sanitary living accommodations for their men, together with facilities for recreation and amusement.

These things are not only dictated by humanitarian feelings, but are recognized as "good business" by the management, who keep their ears close to the ground.

It has been truly said that many mining corporations only acknowledge their obligations to employees when forced to do so. This is but a human characteristic to which we are all prone; namely, to "turn the blind side" to rights of others that we are not specifically required to observe.

When such neglect grows into an abuse that the victims can not longer endure, and they organize and resist the long-standing impositions, there often result strikes and violence.

The disregard of strict principles of right and justice, by employers, has in the past and will again furnish strong arguments and induce men who might not be disposed to countenance the unreasonable requirements of union radicals, to affiliate themselves with the union, and to passively assent to acts naturally repugnant to their better judgment.

We would instance one thing that formed the principal fighting issue of the miners, in the 1900 strike, in the anthracite regions of Pennsylvania; and which was justly designated as "the powder iniquity." For years prior to that strike, the operators had been paying about $1.00 per keg for powder, in car-load lots, and compelling the miners to purchase the same from them, at a cost of $2.75 to $3.00 per keg. A few of the operators, among them the late W. A Lathrop, then general superintendent of the Lehigh Valley Coal Co., endeavored to induce the associated operators to correct this obvious wrong, but without success.

This refusal was largely the cause of the strikes of 1898, '99 and 1900, which greatly assisted the organizers in drawing into their union a majority of the employees, and forcing the operators to the concessions of 1900.

Our reference to these things must not be taken as indicating that we think the organization of employees is inimical to the industry, as notwithstanding some friction, the history of the anthracite business for the past 10 years shows that since the inauguration of collective bargaining, the region as a whole, operators and men, has enjoyed greater prosperity than ever before. We have mentioned this specific instance of the failure of coal operators, collectively to right a long-standing wrong to the men employed, in order to point our tale.

In some, at present, unorganized coal-mining regions, the controlling interests do not seem to profit by the experience of other times and regions; and, because they have so far been able to prevent the organization of their men, continue unjustly to exact extortionate profits on powder, mine supplies, merchandise, etc. Such obstinate disregard of the "golden rule" is bound to foster discontent among the victimized men; and whenever possible the employees will naturally seek employment in mines where fairer treatment is the rule. Those who remain are ripe for the radical labor agitator and for the commission of acts of violence such as have recently marked the strike in the Kanawha field of West Virginia.

Company stores, particularly at mines located far from towns where necessaries can be procured, are a necessity, and there are many mining companies operating their merchandising departments in a manner quite above criticism. We know of many instances where the commissary is truly a beneficient institution to those dependent on it, besides returning a fair profit to the owner.

It is generally conceded that the average bituminous-coal operator has, for several years, had a hard "row to hoe," and needed all the profits he could legitimately obtain from sources other than mining.

The producer has not been altogether blameless for the ridiculously low prices that have prevailed, and he should not expect to make up for his lack of ability in the marketing of his output, by extorting unreasonable profits from those who are, for the time being, in his power.

It behooves those who are doing these things to "set their houses in order," for the day of reckoning will surely come.

Ideas and Suggestions

Interesting Talks Submitted in Response to Our Recent Request for Forewords.

Attributes of a Mine Foreman

BY A PENNSYLVANIA READER

There are several features necessary in the makeup of a mine foreman that are not found in the textbooks, and without those features it is an impossibility for him to become a successful man in the coal business.

It seems to me, after many years' experience in the coal mines and in the handling of men, that the chief attribute of the foreman is his ability to judge of the makeup, character and temperament of the men that apply to him for employment.

The mining law holds him responsible for the life of every man who enters the mine. It states that he shall hire no man to mine coal that is not an experienced miner, unless he puts him in the charge of a miner who is experienced. Since the experienced miner is mining coal to make a living from it, however, it seems but natural for him to object; unless, of course, the foreman is willing to pay him, which would mean increased mining costs.

Then, again, there is the careless miner —the fellow who won't timber his place properly; and if he does escape being killed by his own carelessness, he still causes the foreman endless trouble by having falls occur every now and again in his working place. You will find this same fellow is just as careless in the laying of his road. He throws the rails down in any old way, making it a hard proposition for the driver to haul a car either in or out of his room.

Alongside of these fellows we have also the man who is never satisfied. He spends most of his time in chasing the foreman around to find out if he is going to pay him for every trifling thing that he meets with in the course of his work. This really is the fellow who doesn't want work, but who is looking for nourishment.

There is also the agitator—the fellow who is always trying to make trouble, his object being to have the other men think that he is just the man they need to fill some soft proposition which they have at their disposal. Of course, I know that it is no easy matter to man a large mine without getting in some of these undesirables.

But, at the same time, if the foreman is careful in the selection of the men who apply to him for employment, he will be able to save himself endless annoyances and keep accidents and fatalities down to a minimum.

In conclusion, I would say that I have found it is a great deal easier to hire men than it is to fire them, and it is always a safe rule to size your man up carefully and make some inquiries about him before you employ him. By constant observation you will be able, not only to remember men's faces whom you have not seen in years, but also be able to estimate your man's character at a glance. The average workingman, as a rule, is not educated enough to conceal his failings, which are plainly outlined in his face, speech and actions.

The Wireless Motor in Mining

By Samuel McMahon*

Have you ever thought of the wonderful improvements in coal mining, in the past few years? The man of importance in the "who's who" class of mining men ten years ago amounts to very little today, unless he has been keeping up with the progress of the various inventions of ingenious minds in the mining and handling of coal.

I was much surprised on coming into West Virginia to find a number of prominent mining men seriously considering installing the wireless motor. At first I was much inclined to scoff at the suggestion, but after careful consideration of the facts, I confess I was nearly convinced, that the idea was practical.

Well do I remember the day the boss came to my door in the mine and told me I could drive one of the mules hauling between sidetracks. As I look back on it now it calls to my mind the feelings of the pride I experienced. Whether anyone else thought of it, I was sure that the acme of perfection had been reached in the matter of hauling coal. This feeling, however, wore off as soon as we installed the rope, and when we saw it hauling a trip as big as 10 mules could haul, we renewed our affirmation that the long looked for haulage had been found.

With the advent of the electric motor in its present perfected form, we thought nothing further could be asked for. Our friend Edison, however, thinks differently and we all see in the tremendous expense of installing and maintaining the electric trolley and bond wires an element of costs in coal production that we would be delighted to avoid.

What do you say then to a motor which will give you all the power a trolley motor can possibly produce, with neither trolley wire or bonds? We all know the defects of the overhead trolley-wire system. Particularly in mines where the Pittsburgh seam or other seams with bad roof is being worked, after the first cost of installing, the cost of maintenance is enormous.

Then to come to the bond question, we are all familiar with the way the best bonded tracks loosen up, from one cause or another, and the loss of power caused thereby. View it from several angles and the result is the same—a unanimous vote in favor of the wireless motor, if it can be brought into practice.

The use of the storage batteries and charging stations, adds flexibility to the system. With these to act as receivers of energy, so to speak, the engine and generator need only be run at stated intervals and the current then taken from the batteries at any time and in such quantities as desired. The electric wireless motor has now been brought to a

*Superintendent for the West Virginia, Pittsburgh Coal Co., Wellsburg, W. Va.

high state of technical development, having passed entirely beyond the experimental stage and its wide spread use in the mines appears only a matter of future economic development.

Consider for a moment the fact that one of these motors can be charged in 20 min. and will then run 50 to 75 miles without recharging, developing up to 125 hp., and still keep the size of your machine down to where it can work comfortably on your standard-gage mine tracks and not be too large for your ordinary sized entries.

Add to this the fact that suitable storage batteries for charging can be bought for about ⅙ the cost of an ordinary mine locomotive, or about what it would cost to run and maintain a line of No. 0000 wire up a butt entry. While a wireless motor will cost practically the same as a first-class trolley motor, the latter far exceeds the former in the first cost of installation.

Now I do not mean to have you infer that I suppose the wireless electric motor is going to replace our tried and true trolley motor at once, for the same bias of the human mind, which has opposed progress since the world began will be an obstacle here, but I do agree and I think I have the indorsement of a good many mining men, that the wireless motor brought to a fair stage of perfection will have advantages over the old style of trolley motor that are almost inestimable.

At least it behooves us as men who are on the lookout for new and better things to look them up carefully, with a view to adopting them, should they meet our requirements; and don't be the last to look them up, for they are being given an honest test in several places and so far, are delivering the black diamonds to the tipples with as much ease and more regularity than the old style, and as far as I am able to judge, they are with us to stay.

Discussion of the B.t.u. Method

By A. Bement*

On p. 419, in the issue of Sept. 28, Harry N. Holmes has an article under the above title, in which he presents certain statements and arguments concerning the value of fuel and its purchase, to which I offer some remarks, as follows:

It is natural the purchase of coal should prevail under some form of definite specification, also that a method of valuing should be employed. This is true, because people have become familiar with such methods in the purchase of many other commodities, such, for example, as steel or cement. Thus a leaning toward this process was established, and it has followed that coal has been placed in the classification with manufactured materials.

In so doing, however, the fact has been overlooked that fuel is not a manufactured product. It differs in this respect from steel or cement, in which the maker can, and does, control the entire composition and all of the ingredients. This is true, because coal has been formed through natural processes. Therefore, the coal producer's power is limited to matters of mining and preparation. He cannot, for example, influence the heating-power value as a steel maker can control carbon content, nor can he limit the sulphur content as is done in metallurgical processes.

Impracticability of Specifications

These facts, however, appear to have been generally overlooked by many consumers in their specifications. This is apparent from the fact that in many instances an anthracite, or semi-bituminous quality, has been specified and demanded from a purely bituminous locality. The only requirements that the purchaser may justly insist upon are the size of the coal, its ash content and the seam from which it is produced. Heating power, fixed carbon, volatile matter and sulphur, for example, are all constants established by nature. It is true, however, that when purchase is made from a dealer, who, in turn, must buy from a producer, the proposition is not so simple, because for purposes of identification, it may be essential to employ a heating-power determination.

The greatest difficulty, however, with this business is that coal is a very low-priced commodity, for which reason it is not practicable to spend much money in testing it. In this respect it is quite different from steel and other materials, the cost of which is so much more that it is possible to spend sufficient money to insure that the work be properly done, and that both parties to the bargain be represented in the test. That portion of the coal-testing work most liable to go astray, is the sampling. If all was told that could be said about sampling methods, as often practiced, it would make quite a scandalous story.

Thus far the greatest benefit derived from the use of this method of buying and testing coal has been the education of the purchaser. This has, in many instances, resulted in his being able to make the best selection of fuel available to his locality without the aid of any specification or test.

Claims of Bureau of Mines

Mr. Holmes states that government tests have shown that when the ash content reaches 40 per cent., the fuel is valueless. In correction, I would say that neither the Technologic Branch of the Geological Survey nor its successor, the Bureau of Mines, have published anything to that effect. It is probable that he has in mind certain experiments made in Chicago some years ago. These tests were conducted by myself during the year 1905, and the results were presented by W. L. Abbott before the Western Society of Engineers, published on page 529, Vol. 11, of the sicoety's *Journal.*

First Purchase of Coal by Specification

Another correction, which will be of interest, concerns the first use of a systematic method of purchasing coal under specification. Mr. Holmes credits this to the Bureau of Mines, when, in fact, it was first employed in Chicago. In the years of 1904 and 1905, the Fuel Engineering Co., of Chicago, had its scheme of purchasing by specification, method of testing, and manner of valuing, well established. This method became quite well known, attracting general interest and attention prior to 1906. The first purchase of coal by the government under the form of specification and method of determining value, devised by the Technologic Branch of the Geological Survey, occurred in the winter of 1906 and 1907. The results of the experience with this specification, and method of determining value, were described in Bulletin 339, issued in 1908.

With reference to Mr. Holmes' statement that a million tons of fuel per year is now being handled by one concern in Chicago under contract similar to that of the government, I will say that the total amount of coal now bought at Chicago under specification is less than that amount. About 1908, the Fuel Engineering Co. handled a tonnage of a million or more, but the amount rapidly declined, so that at present the entire business of the three concerns now in Chicago is less than that amount. The business formerly conducted by the Fuel Engineering Co. has been taken over by the Krehbiel Co., and fuel testing is only a branch of its work.

*Consulting engineer, 29 So. La Salle St., Chicago, Ill.

Snap Shots in Coal Mining

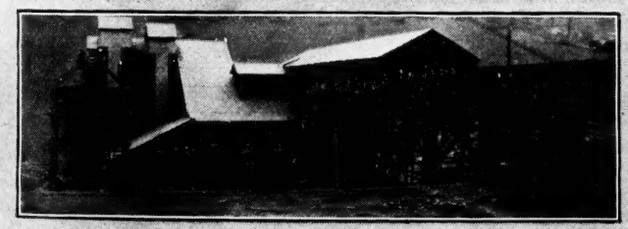
We Will Pay $5 for the Best Photograph Published Here Each Week.

Showing One Of The Power Houses Clinchfield Coal Corporation Dante, Va

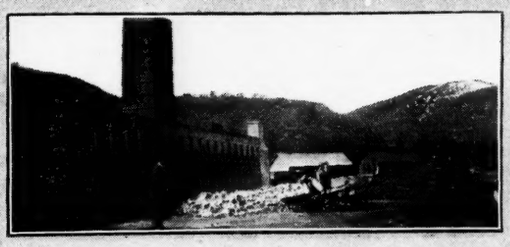
Tipple Floor Of Marianna Mine, Pittsburg-Buffalo Co. Marianna, Penn

The Diamond C & C Co's No 2 Mine Mouth At Oakly, Wyo

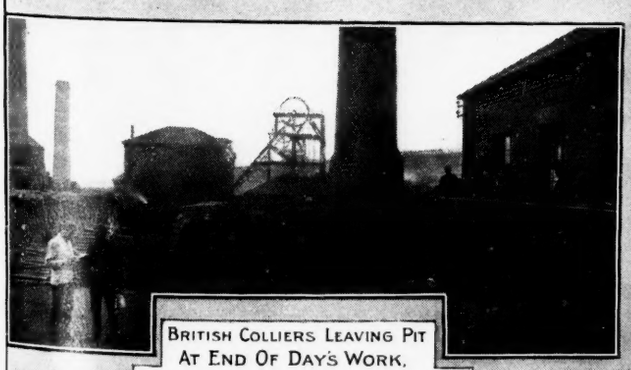
Lille Mine No 1 Situated In The Crow's Nest District Of Canada



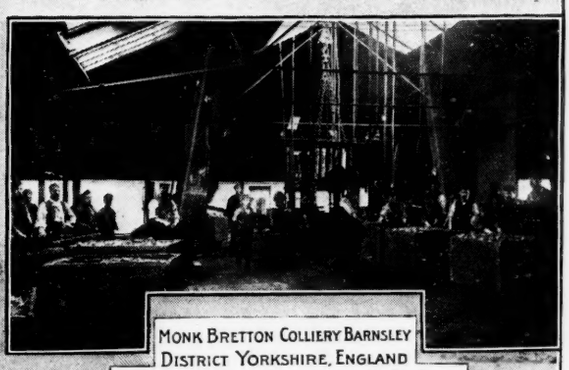
Coal Washing Plant Designed By Roberts & Shaefer Co. Of Chicago For Zenith Coal & Coke Co., Crumpler, W Va



Battery Of Belgian Coke Ovens At Lille, Near Frank, Alta., Canada Ovens Are 30 Ft Long, 7 Ft High & 2½ Ft Wide



British Colliers Leaving Pit At End Of Day's Work, Silkstone Mine, Yorkshire England.



Monk Bretton Colliery Barnsley District Yorkshire, England Showing Cars Of Coal As Sent Up The Shaft

Coal Age

Electric Wiring at Penn Mary Mines

Special Correspondence

Signalling wires are carried on cleats, suspended from the roof and are of galvanized iron. The bare feeders are not fastened to porcelain insulators but are held on hooks which are secured to the roof by the standard trolley-wire suspenders, these being less subject to breakage.

Fig. 1, in the issue of Nov. 9 (Vol. II, p. 641), shows a general layout of the wiring within the Penn-Mary mines. It indicates, however, only the power conductors. Signal and telephone circuits are not shown. Fig. 1, of the present article, shows a sectional view of a typical main entry, and illustrates how the electrical conductors are located in it.

The trolley wire is placed on one side of the track, so as not to interfere with men walking along the entry. The telephone and signal wires are supported on the cleat detailed in Fig. 2, which is set directly over the center of the track.

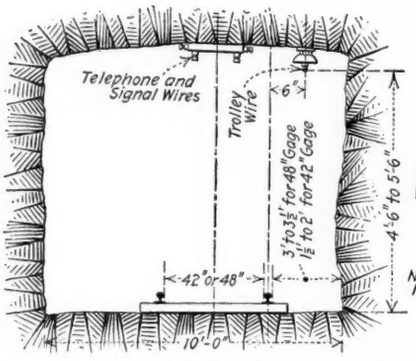


FIG. 1. TYPICAL SECTION SHOWING WIRING IN A MAIN ENTRY

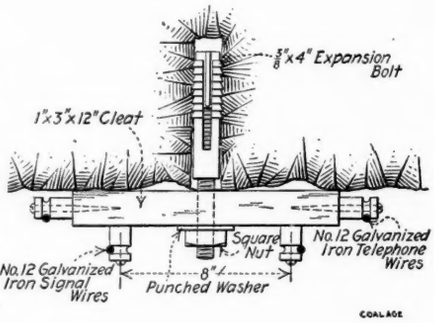


FIG. 2. DETAIL OF CLEAT SUPPORTING SIGNAL AND TELEPHONE WIRES

GALVANIZED-IRON SIGNAL WIRES BETTER THAN COPPER

The signal wires are installed only in the entries where there is hoist haulage, and are used to signal the hoisting engineer outside the mine. The motorman or trip rider can reach up and bring the two signal wires together. This rings an electric bell in the hoist house, where the operator is located.

Galvanized iron is used for the signal and telephone circuits where they are run open. It has been found that soft-drawn copper wire stretches so much that it cannot be used, and hard-drawn wire is so brittle that it breaks frequently. Experience indicates that good galvanized-iron wire will last at least 10 years in the Penn-Mary mines.

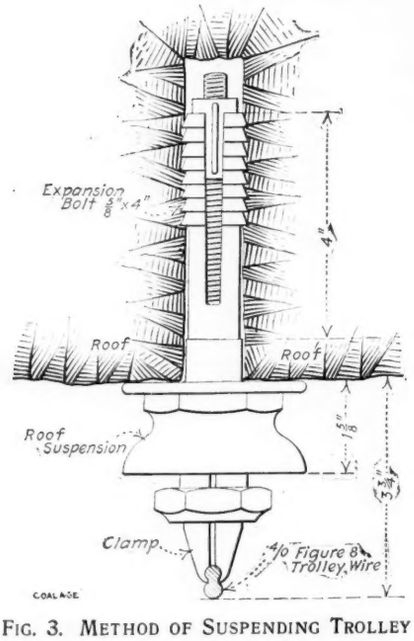


FIG. 3. METHOD OF SUSPENDING TROLLEY WIRE IN A SLATE ROOF

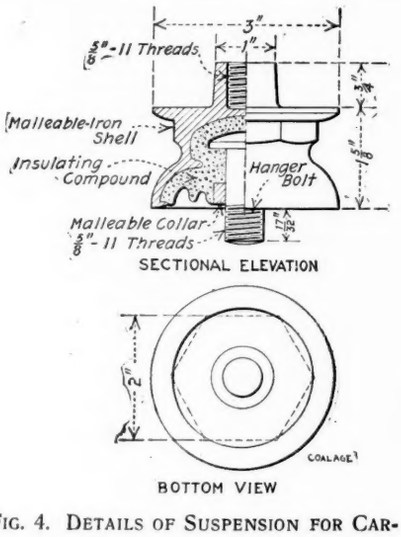


FIG. 4. DETAILS OF SUSPENSION FOR CARRYING TROLLEY AND POWER LINES

THE TROLLEY-WIRE SYSTEM

Fig. 3 shows the hanger and clamp and the method of supporting them in slate roof. Hangers of the type illustrated were selected because they occupy a minimum vertical space in the entry. A ⅝-in. expansion bolt (described in detail later) is used for supporting the hanger.

Trolley wire having a figure-of-eight section is used throughout, because the process of erection is thereby much simplified, and trolley-wheel wear is reduced to a minimum at the hangers. The details of a suspension similar to those used by the Penn-Mary company are given in Fig. 4. The hanger is screwed onto the expansion-bolt stud with a wrench, which engages the suspension on that part of the malleable-iron shell, which is cast hexagonal.

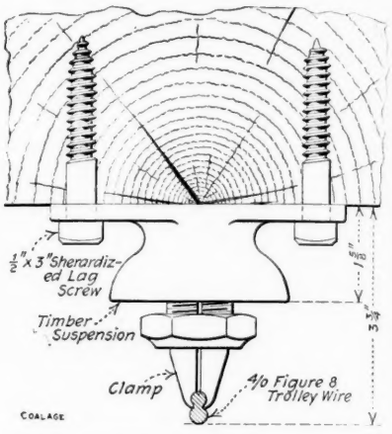


FIG. 5. METHOD OF AFFIXING TROLLEY WIRE TO TIMBERS

Supports for the trolley wire are installed not more than 20 ft. apart on tangents, and not more than 5 to 6 ft. apart

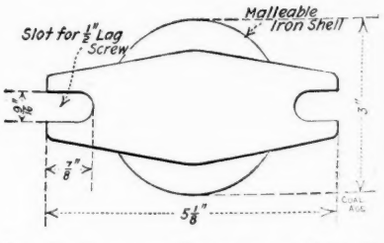


FIG. 6. PLAN OF SUSPENSION USED IN TIMBERED ROADWAYS

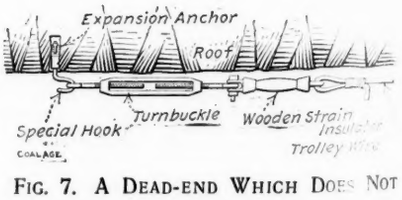


FIG. 7. A DEAD-END WHICH DOES NOT PULL OUT UNDER THE STRAIN

on curves. These spacings conform to the Pennsylvania mining laws.

For carrying the trolley wire on timbers, the method of suspension illustrated in Fig. 5 is used. A plan of the hanger viewed from above is shown in Fig. 6. It is secured to the mine timbers by two ½x3-in. lag screws. The same wire grip for clamping the trolley wire is used with this as with the standard roof suspension. The vertical space occupied by both

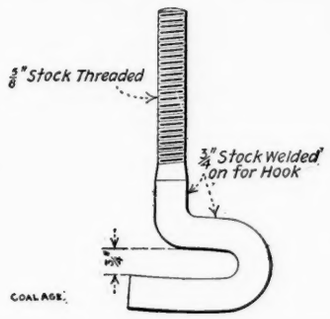


FIG. 8. A HOOK BOLT USED IN SECURING THE ENDS OF TROLLEY WIRES, ETC.

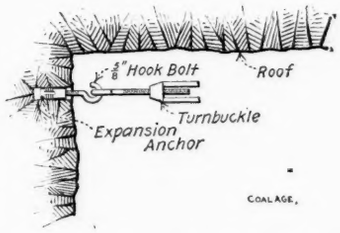


FIG. 9. AN UNRELIABLE DEAD END WHERE THE PULL ON THE BOLT IS DIRECT

the timber and the roof-hanger installations is the same.

MANNER OF INSTALLING DEAD ENDS

For dead-ending trolley wires, two methods are used. Turnbuckles for pulling out slack are mechanically connected in series with the trolley wire at every dead end. Fig. 7 shows that method of dead-ending which is most frequently adopted. A wooden or composition strain insulator separates the trolley wire electrically from the turnbuckle and hook bolt. Into the expansion anchor is screwed a ⅝-in. hook bolt, Fig. 8. It is made by welding a piece of ⅝-in.-diameter stock to a ¾-in. rod. The end of larger diameter is then bent into a hook, the other end being threaded. Because the pull on the expansion anchor is a "side strain," the anchor does not tend to pull out. Hence the attachment is reliable and permanent. Another method of dead-ending is shown in Fig. 9, where the pull on the expansion bolt is direct. This is rarely used and is not a desirable form of construction.

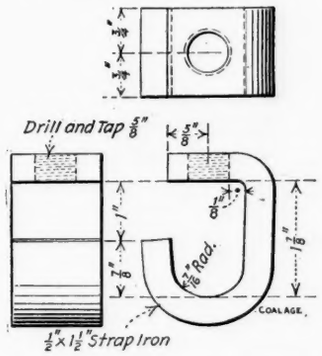


FIG. 11. DETAILS OF THE HOOK ON WHICH BARE CONDUCTORS ARE SUPPORTED

DISPENSING WITH GLASS OR PORCELAIN INSULATORS

For carrying 250-volt, direct-current feeders in the headings, the arrangement shown in Fig. 10 is used. It consists of a standard trolley-wire suspension, onto the stud of which is screwed a piece of strap iron (see Fig. 11 for detail), which has been bent into the form of a hook. Bare copper feeder conductors are supported by the hooks as shown.

The supports are installed every 15 or 20 ft. along the conductor. Although glass or porcelain insulators are considerably cheaper in first cost than the trolley-wire suspensions, they are more expensive in the end, because the miners break the glass insulators either accidentally or maliciously. This permits the charged feeder conductors to drop to the ground and to make no end of trouble.

The largest conductor used around the properties is a 500,000 circ.mil cable, and the opening in the supporting hook is 1

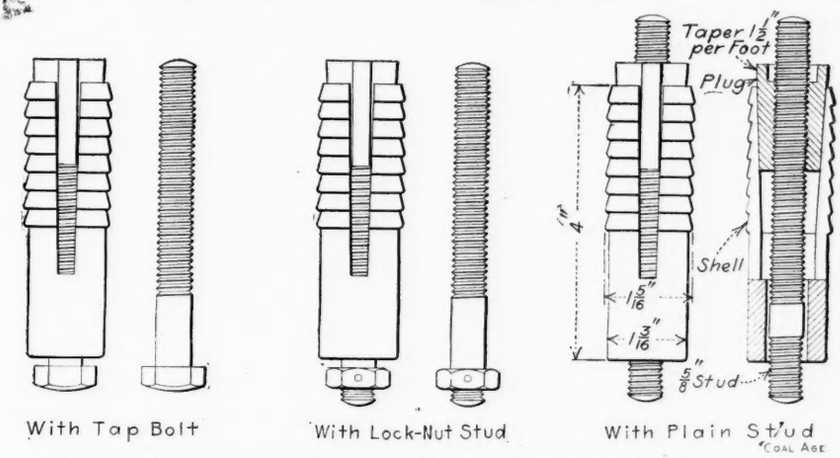


FIG. 12. ANCHOR BOLTS USED FOR VARIOUS PURPOSES. THE RIGHT BOLT IS SUITED FOR TROLLEY-WIRE SUSPENSIONS, THE LEFT PAIR FOR SUPPORTING CLEATS

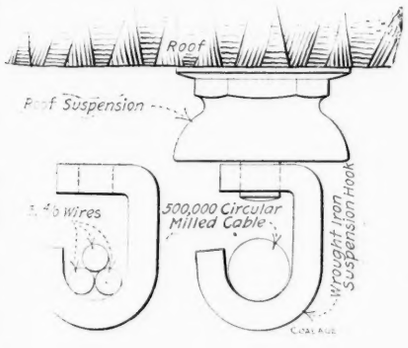


FIG. 10. ARRANGEMENT FOR SUPPORTING FEEDER CONDUCTORS IN HEADINGS

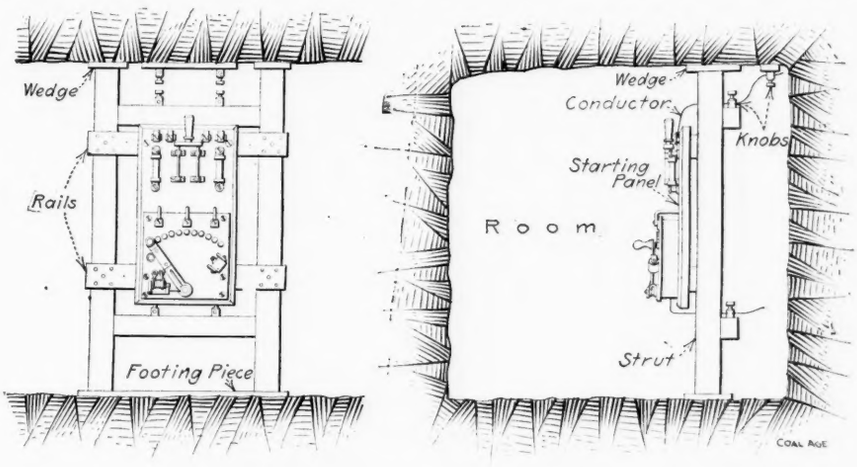


FIG. 13. FRONT AND SIDE ELEVATIONS OF AN OPEN MOTOR STARTER FOR ERECTION IN THE ROOMS OF A MINE

in. wide to admit conductors of this size. Three or a less number of No. 0000 wires can readily be carried by the device, as shown to the left of Fig. 10. Thus only one size of hook is used, and it serves for all applications.

The feeder conductors which are carried along in the workings with the supporting hook arrangement of Fig. 10, are anchored at the ends of the runs by one of the methods hereinbefore described. With a multiple conductor-run, an anchor is used for each wire.

Anchor bolts of the construction shown in Fig. 12 are used in the Penn-Mary mines, this construction being particularly adapted for slate. The ⅝-in. size is utilized in nearly every case. It should be noted that the same anchor and wedge is used for bolts of all of the types illustrated. The bolt with the plain stud is the one best adapted for supporting trolley-wire suspensions. The anchor with

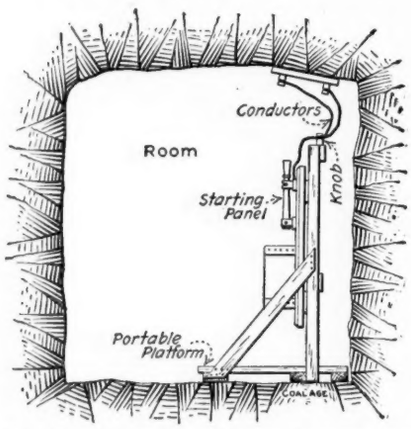


FIG. 14. A PORTABLE MOTOR STARTER FOR USE UNDERGROUND

a tap bolt serves in applications like that of Fig. 2, where some member must be supported to the roof or wall.

When installing the anchor bolt, a 1½-in. hole 5 in. deep is drilled into the roof, and the anchor with the wedge just entering it, is driven into the hole thus formed. By turning the bolt, in the case of a tap bolt or lock-nut stud, or by screwing a nut or other member on, in the case of a plain stud bolt, the wedge is drawn down into the anchor and expands the serrated sides into the rock, forming a firm attachment. Illustrations referred to previously show applications of expansion bolts.

Soft-drawn No. 00 wire, held in the holes in the rails with a steel channel pin, is used for bonding the rail joints in the Penn-Mary mines. To comply with the Pennsylvania coal-mining laws, the rails are crossbonded every 200 feet.

METHODS OF MOUNTING MOTOR STARTERS

The usual method of supporting an open motor starter in a room in the mine is shown in Fig. 13. Wooden struts of, possibly, 4x4-in. timber are wedged between the roof and the floor. The wooden rails, by which the starter panel is supported, are nailed to the struts. A cleat or two, to support knobs for insulators, are nailed to the struts at the back, thus completing the arrangement.

Sometimes it is desirable to arrange a starter so that it can be readily moved about in the mine. For such service a portable support can be built, as suggested in Fig. 14. The entire equipment can be placed on a car and shifted from place to place with minimum expense.

The Penn-Mary Coal Co. is now purchasing inclosed starters exclusively. These have no charged metal or conductors exposed, and the only part to which the ordinary attendant has access is a switch handle for starting and stopping. Repair men have keys with which they can open the doors, rendering accessible the few parts of the control mechanism.

The inclosing cases for these starters are of cast iron and are arranged so that they can be set on the mine floor at any point without risk of injuring the apparatus inclosed by them. All the equipment described in this article is supplied by the Westinghouse Electric & Manufacturing Co.

Estimating Strength of Pillars

BY R. G. LOVE*

The mining men of the present day smile as they consider the earlier days of the coal-mining industry, when wide rooms were driven even in the thickest seams on close center lines. In a great many instances, this mining has caved and squeezed, occasionally to such an extent as to threaten the destruction of large areas of valuable coal. Pillars can be found which are but 20 ft. in width in a 12- or 14-ft. seam, several hundred or a thousand feet below the surface.

In the past, the conditions met with were unknown and, at best, they could be only surmised. The mining man went about his work cautiously. He knew that the coal was plentiful and cheaply mined, but he would not, for one moment, have done anything that would have threatened the destruction of any portion of his workings. When trouble did come, he profited by his mistakes and immediately began to leave larger pillars. When these were found to give good results, the same size was used whenever similar conditions were encountered. Thus, mining has progressed until, at the present time, there are so many examples from which to copy, that an experienced man can nearly always guess the size of pillar required. But the same method of trial and error for determining pillar thickness is still being used as in the beginning.

The structural engineer calculates the size of the different members of a structure before it is commenced. Is it not possible in like manner for the mining man to calculate the size of pillar required before commencing to mine?

The strata overlying the seam to be considered, is pierced by diamond-drill holes, which tell the thickness of the different strata and bring to the surface a core from which their specific gravity may be obtained. Hence the weight that will come on the pillars can be determined, but that is all. Newton said that for every action there is an equal and contrary reaction. The action, in this case, is known to be the weight of the superincumbent material, but the reaction, the stresses in the pillars, is unknown.

The structural engineer can calculate the size of the different members of his structure because he knows the strength of the materials from which it is to be built. He knows the strength of the many different varieties of steel, iron, wood, concrete, masonry, etc.

There have been very few experiments made, however, to determine the strength of coal, and as there are many kinds of coal, many experiments would be required before reliable results could be obtained. Such experimenting takes money, and few are willing to advance the funds.

While the mine-cave agitation and the talk of replacing the pillars with concrete and other structural materials are in their prime, and while the people are fully awakened to the dangers of mining, it would be an opportune moment to propose that the United States Bureau of Mines compile tables showing the sustaining strength of the different varieties of coal. This would furnish a means of determining the size of pillars and the amount of structural material required to replace the pillars that are to be removed in places where the surface must be protected.

[The Scranton Engineers' Club, in July, 1900, appointed a committee of five coal-mining engineers, to investigate and report upon the compressive strength of anthracite coal. The work of this committee was very complete and their report gave the results of the compressive tests made on 425 samples of anthracite coal, sent them by the operators of the northern anthracite field.

This report, which was copyrighted by the Scranton Engineers' Club, was later made the basis of an exhaustive investigation by Engineers William Griffith and Eli T. Connor. appointed to this duty by the Mine Cave Commissioners of Scranton, September, 1910.

The Federal Bureau of Mines might well consider extending the work done by these engineers in the anthracite field, to determine similar data in the several bituminous fields of this country.—EDITOR.]

*Scranton, Penn.

Significance of the Counter Current

By John Verner*

The flame of an explosion feeds on the rear of the dust column, so there must be fresh air behind the dust. This air is supplied by the return draft. The coked dust on the leeward side of projections is also deposited by the counter-current. The increase of violence as the mine mouth is approached is a result of increased back draft. Revolution of cars at Hastings is proof of counter-current. Stone dust from stone-dust zones meets flame before the zone is penetrated.

*Chariton, Iowa.

In the two previous articles,* I have endeavored to show the existence of a draft, which not only *succeeds* the rush of air from the center of an explosion but is contemporary with it yet opposed to it in sense.

Dust Precedes Flame and Flame Precedes Explosion

Regarding the appearance of the Bruceton explosion of Feb. 24, 1912, it is said that "A black cloud of dust shot out of the main entrance, accompanied by a tongue of flame, and a violent detonation occurred. The smoke from the main entrance increased in volume for a few seconds and then a reverse current set in."

In regard to the appearance of one of the Altofts explosions at the entrance of the gallery, the report states: "There was a small cloud of dust, immediately followed by flame, then a violent explosion and dense smoke." It will be seen that the manifestations in both cases were practically identical and may be regarded as conditions typical in this respect to those in all dust explosions.

It will be noted that the sequence was dust, flame and smoke. This proves: First the existence of a force which stirred up and drove the dust ahead of the flame.

Second, the presence and direction of draft strong enough to drive back the smoke over a considerable distance behind the flame (a fact substantiated by the evidence furnished at the Repauno testing gallery and discussed in my previous article), and third, the existence of an area of depression or a vacuum in the flame zone sufficiently complete to produce this draft, owing to which not only the smoke was forced back, but at the same time the fresh air necessary to promote combustion was supplied.

This air in passing through the space where stirred-up dust was whirling became loaded with it and thus carried it into the flame under conditions most favorable for instantaneous and voluminous ignition. In the absence of draft the presence of smoke would be as pronounced ahead of the flame as the presence of smoke behind it and in that case the flame would be rapidly extinguished.

The Presence of Coked Dust

There are several well known features connected with dust explosions regarding which little or no explanation has been offered, but which could be fully explained when considered in connection with the effects of the presence and action of the counter-current or draft.

For instance, it has been observed (see pp. 94 and 95, bulletin 20, Bureau of Mines) that near the starting point of the explosion coked dust is projected directly upon the surfaces facing the source of the explosion. As the velocity of the explosive wave increases, the coked dust is no longer deposited on the facing surfaces but on the under sides of collars and the lee side of timbers, etc.

As the explosive wave gains further in velocity practically no coke is deposited in the main passageway traversed, but the coke dust appears again on the facing surfaces when the explosion dies away. There may be a seeming relationship between the velocity of the explosion and the manner of dust deposition. But it is difficult to believe that the degree of velocity, as suggested above, is the determining factor in this respect and that, for instance, an increased velocity prevents the deposition of charred and coked dust on the facing side of a collar and the same time aids in depositing such dust on the under side of that collar.

Is the Coked Dust Deposited by the Counter-Current

However, when this matter is considered in connection with the counter-current or draft, doubtful conjecture gives way to definite conclusion, for it then appears that not only the presence, absence and manner of deposition of charred and coked dust, but the velocity of the explosive wave itself depends on the degree of force developed by the counter-current and on the volume of its air supply.

It further appears that the draft and the flame of the explosion are interdependent, that one cannot exist without the other.

Near the starting point of the explosion little coked dust is deposited on the lee surfaces because the draft or counter-current, caused and attracted by the vacuum in the flame zone, is not yet strong enough to project the dust with sufficient momentum to force its adhesion to these surfaces.

At the place where the explosion dies away, the lee surfaces show no dust deposits because the counter-current has practically ceased to exist. The presence of coked dust on the roof, the under and lee sides of collars can reasonably be accounted for by the effects of the inward and upward sweep of the increased draft.

One Reason for Increased Violence at Mouth of Drift

Draft facilities improve as the explosion approaches the mine opening and the ingoing draft increases correspondingly in force and volume, resulting in the more complete combustion of the dust and therefore little or no coked dust is found on the collars and timbers along that part of the route of the explosion, although there may be much evidence of flame.

It has been observed at Bruceton that the velocity of the explosion and the speed of the flame increased as the distance between the explosive wave and the mine entrance decreased.

Flame More Rapid than Pressure in Propagation

Regarding the acceleration of flame, observed in the Bruceton explosion of Feb. 24, 1912, it is said: "An interesting fact in connection with the recording of the velocities of the pressure wave and the flame was that the flame while much behind the pressure wave at the start caught up rapidly with it as the entrance was reached."

No explanation is given for the acceleration of the flame, but evidently it was caused by the increase in draft and the greater air supply available as the explosion approached the mine entrance. This resulted in increasingly rapid combustion and therefore must have correspondingly quickened the speed of the flame.

The Hastings Disaster

Only a few months ago a destructive explosion occurred in the Hastings mine, Colorado, and 12 of the 13 men at work were killed. (For description of mine see *Coal Age*, Vol. II, page 5). The mine was new, of comparatively re-

*"Conditions Favoring Dust Explosions," Oct. 12, and "How a Dust Explosion Sucks in Air," Oct. 26.

stricted extent and quite wet and so far as dust is concerned, it is said that Hastings has always been considered one of the safest mines in the Trinidad district.

The mine made a small amount of gas, but being new, with draft facilities good and a large air volume passing through the mine, and as no open lights were permitted and only permissible explosives used under the supervision of shot firers, no great danger was apprehended on that account.

But an explosion occurred nevertheless, and apparently it was started by the ignition of gas at the face of an entry in the south part of the mine, but as the coked-dust deposits on the timbers, etc., were very plain, the propagation of the explosion was evidently due to dust, notwithstanding the fact that the mine was particularly wet.

Moistening Is an Insufficient Precaution

The occurrence of this explosion adds to the already abundant and conclusive proof that the moistening of the dust cannot be depended on to stop an explosion under way.* It is remarkable that in the face of the most direct proof to the contrary, the belief in the effectiveness of this alleged preventive remains general and unshaken.

When it was found that an explosion had stopped in the wet part of the road that fact was generally cited as conclusive proof of the effectiveness of moisture. Closer investigation might have shown that there were other and perhaps more potential causes at work which helped to stop the progress of the explosion in that particular place.

When it was found that the flame of the explosion had swept through long, wet and non-gaseous stretches, some of them known to have been between a quarter and a half mile in length, with the dust in moist condition, all sorts of excuses and theories were offered why the explosion was not stopped. There was a decided reluctance to accept the evidence of plain facts and profit by the lesson they presented.

I do not say that the presence of moisture has no merit; on the contrary, I believe that the introduction of moisture into naturally dry mines where there is danger of dust ignition is desirable and beneficial, provided the limitations of its value are fully understood. At present that value is generally overestimated.

Moist Dust When Raised Will Burn

Of course, moistened dust cannot burn with explosive effects as long as it remains packed on the floor or sticks to the coal, timbers and roof, but there will be no appreciable impairment in its combustibility if the moist dust deposits are torn from their resting places, the dust particles separated from each other, thrown in suspension and then brought in contact with the flame.

The Counter-Current at Hastings

The manner of raising the wet dust in the Hastings explosion is shown in the following statement: "There were a few cars standing on the slope near the mouth of the back entry of the 3rd South, and *these seemed to have been subjected* to practically equal forces traveling in opposite directions, as they were turned completely around and badly broken up."

Here is plain evidence of the presence of the counter-current and the possible magnitude of its force, in this case, as in many others, almost equal to that of the explosive wave itself and surely powerful enough to dislodge the moist dust, separate its particles and carry them to the flame, thus propagating it about as readily as if the mine had been dry.

The results of experiments at Altofts have shown that by the use of dry, fine stone dust placed in zones of comparatively short lengths, the flame of the explosion was extinguished within a very short distance after entering the stone dust zone. It seems that the experiments to test the effectiveness of stone dust as a flame extinguisher was undertaken because it had been found in the investigation of mines after the occurrence of explosions in them, that the roads where noncombustible shale dust predominated were little or not at all affected by the explosion, while the roads containing accumulations of coal dust were traversed by it.

How Stone Dust Meets the Flame

Just in what manner the stone dust arrests the progress of the flame appears to be still a matter of conjecture. At Altofts and other experimental plants, the stone dust was generally placed on wooden shelves or on brattice cloth suspended near the roof, and it has been suggested that after the violence of the explosion had upset or destroyed the shelves, the stone dust would fall in a shower on the flame and thus extinguish it.

But this is not probable for it is well known that the flame of the explosion, moving at a tremendous speed itself, is preceded by a propelling force, moving at least as fast as the flame, that drives forward the coal or any other dust, and under the circumstances there is little chance of the stone dust falling on the flame.

However, there is another and more certain way. The power of the counter-current or draft which apparently was so effective in the Hastings explosion in raising the moist dust and injecting it into the flame for its propagation would be just as effective in extinguishing the flame by the forceful injection of the stone dust.

Stone Dust vs. Cleanly Headings

The possible influence of this draft in enlarging the flame or in stopping its advance can be shown with the help of illustrations 1 and 2. They give the conditions under which two tests at Altofts were made and their observed results.

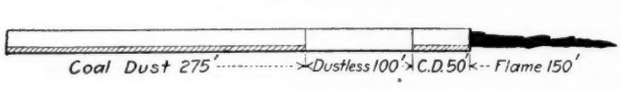


Fig. 1. Explosion Passes Dustless Zone

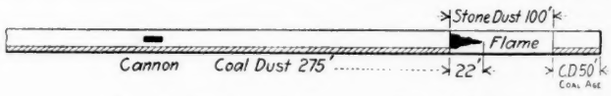


Fig. 2. Explosion Dies in Dusty Zone

It will be noted that the only difference in the arrangements for the tests was that in one (Fig. 1) a dustless zone, 100 ft. in length was used, while in the other (Fig. 2) a stone-dust zone of the same length was provided. In the second test the flame was extinguished after penetrating the stone-dust zone only 22 ft.; in the test with the dustless zone the flame spread across the fuel-less gap and extended 150 ft. from the entrance of the gallery.

The flame produced in the latter test extended 278 ft. further than in the former and the presence of the dustless zone had no apparent effect whatever in decreasing the length of the flame. In one test the counter-current helped to extinguish the inflammation, in the other it helped in its extension.

This must be true, because the flame, preceded and projected by the great force of the explosion and traveling at a speed of more than 1000 ft. per second, could not have been stopped within 22 ft. of the near edge of the stone-dust zone if it had not been met by the presence of a counter-force which probably threw the stone dust against and

*We cannot follow Mr. Verner in this statement. The explosion at Hastings apparently did not extend to the surface. Its existence was only discovered on the outside by the smell of fire. If moisture did not arrest the explosion, what did? —Editor.

into the advancing flame even before the latter had reached the edge of the stone-dust zone.

Nor could the coal dust near the entrance of the gallery have been so effectively utilized in the extension of flame as shown in Fig. 1 had it not been for the existence of an opposing force that caught and carried this dust into the dustless zone and to the flame.

Draft has been termed the heart of combustion and so it may rightly be said that draft is the heart of a dust explosion. The proof of the necessity of its presence to produce dust ignition with explosive effects and to aid in the rapid propagation of flame will be of material assistance in devising means of prevention and limitation.

Air action in starting and extending an explosion is probably even a greater potential power for harm than the presence of the dust itself, and this power when once brought into existence is almost entirely beyond the control of man.

The mine manager and the miner should realize that no sure artificial preventive of the spread of a dust explosion can be supplied and that the safety of any mine in this respect, no matter how perfect and adequate the visible means of prevention may appear, must ultimately depend on the full and general understanding of the nature of the danger and on the intelligent and willing coöperation of all to avert it.

A New Type of Mine Air Humidifier

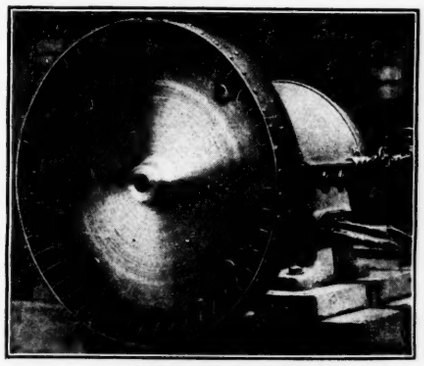
The United States Bureau of Mines has on exhibition at its Pittsburgh testing station, a machine for producing a water mist which is almost fine enough to be termed a fog.

The machine consists of a hollow wheel mounted upon the shaft of an electric motor. The wheel is provided at its periphery, with spray nozzles, at its hub, with an opening for the admission of water, and on its back with fan blades. The back and rim of the wheel are enclosed in a steel housing which serves as a casing for the fan, as a support for the air diffusion vanes, and as a shield for the revolving parts.

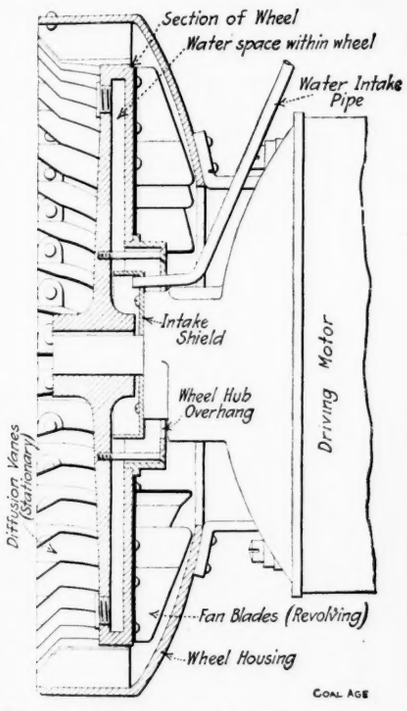
When the wheel is rotated at normal speed by the motor, and water is admitted (under practically no pressure) to the opening in the hub, centrifugal force develops an hydraulic pressure of more than 200 lb. per sq. in. at the nozzles in the periphery of the wheel. This pressure drives the water through the nozzles in the form of a fine spray which is seized, broken up still more, and finally carried away by the blast of air which the fan blades on the back of the wheel blow out all around the rim of the wheel between it and the surrounding housing. The diffusion vanes cause the air to be discharged in the form of a cylinder, the axis of which is coincident with that of the fan shaft.

The mist produced is extremely fine and there is practically no dripping of solid water. The device which was developed by H. H. Clark, one of the bureau's engineers, is not yet in its final form, and has not been tested in actual practice.

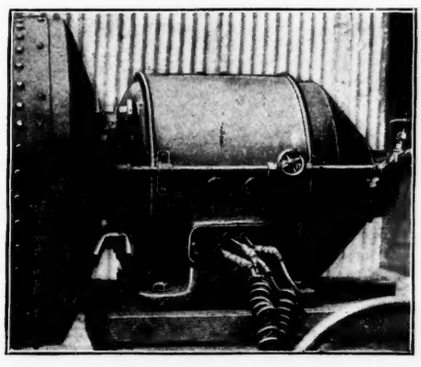
If this atomizer will not overcome the reluctance of air to absorb water in a solid form, then all future attempts may well be abandoned. It is doubtful whether the apparatus will do the work for which it is planned because air so far has been successfully humidified only by the use of steam, but the scheme is worth trying and reflects much credit on Mr. Clark.



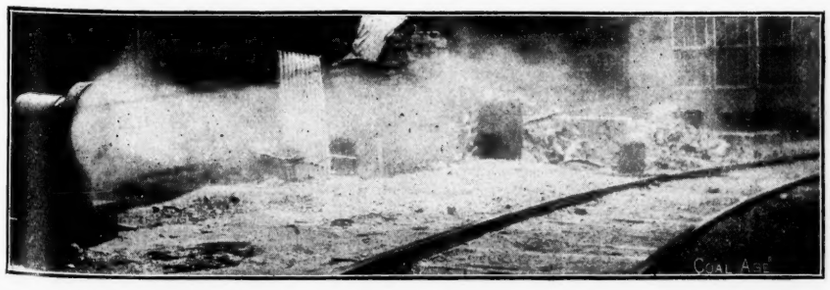
FRONT VIEW OF SAME, SHOWING BLADES FROM WHICH FOG IS DRIVEN



SECTION OF FAN AND CASING, SHOWING MANNER IN WHICH WATER IS ATOMIZED



SIDE VIEW OF HUMIDIFIER AND MOTOR RUNNING 2400 R.P.M.



FOG ESCAPING FROM CLARK'S HUMIDIFIER INTO THE OPEN AIR. NOT A CONDITION FAVORING TRANSMISSION OF CLOUD

NOTICE

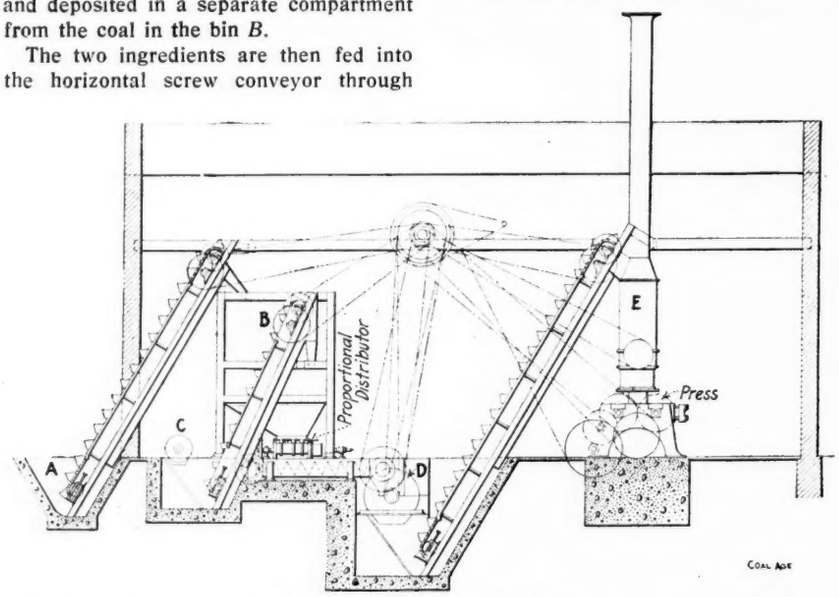
The Dec. 7 issue of COAL AGE will be given over entirely to subjects relating to the use of electricity in coal mining. In other words, we shall make this particular issue of our paper a purely electrical number. All our readers are invited to contribute appropriate articles to this issue, based on their experience in the use of electricity at coal mines. Help us to make this special number of COAL AGE the most complete paper on the subject ever published.

The Devillers Briquetting Apparatus

The accompanying diagram shows a general cross-section through the Devillers Briquetting plant, located in Brooklyn, N. Y. This operation was designed merely for demonstrating purposes, and has a capacity of only six tons per hour, of egg-shaped briquettes, weighing about 40 grams each.

The material for briquetting is unloaded in the elevator boot *A*, from whence it is elevated into storage bin *B*. A hard pitch is used as the binder, and this is crushed or pulverized by means of the small crusher shown at *C*. After crushing, the pitch passes into the elevator boot and is hoisted by the elevator and deposited in a separate compartment from the coal in the bin *B*.

The two ingredients are then fed into the horizontal screw conveyor through the proportional distributor shown in the diagram. This distributor automatically regulates the flow, and hence insures a correct proportioning of the mixture. The coal is carried, by means of the conveyor, into the pulverizer shown at *D*. This pulverizer reduces the material to a fine powdery consistency, and, at the same time, effects a complete mechanical mixture of the two ingredients.



SECTION THROUGH THE DEVILLERS BRIQUETTING PLANT AT BROOKLYN, N. Y.

Passing from the pulverizer into the elevator boot, the coal is then hoisted into the mixer *E*. At this point the material is reduced to a pasty consistency, and fed by means of a screw conveyor into press. The screw conveyor is used to insure an absolutely constant and regular feed.

The press is the well known Devillers cylinders placed tangent to each other and having indentations in the face where the briquettes are formed. It is of heavy, substantial construction throughout, and springs are provided for emergencies. No baking or drying process is used, and the briquettes are hard on coming out of the press. They may be immediately used in the fire box, or are ready for transportation, during which they withstand disintegration quite well.

To operate the plant, four men are required as follows: One combination engineer and fireman, one foreman, one stoker and one man at the proportioning distributor.

Locking Device for Disconnecting Switches

The General Electric Co. has recently developed a locking device that effectually prevents the blade of a disconnecting switch from opening except when intentionally operated by the attendant. Instances are on record where such switches not protected by this device have opened or partly opened by magnetic repulsion, and have been destroyed when a short-circuit has occurred on the line. This results not only in the loss of the switch, but the circuit on which it is installed is out of commission until another switch can be put in place.

The safety catch or locking device is a unit in itself, and can be applied to any G. E. type L, form G-6 switch, merely by clamping it to a support placed between the clip block and the insulator cap, and can be operated with a switch hook.

This device does not interfere with the regular operation of the switch. It is made ordinarily to fit 300-, 600-, 800- and 1200-amp. switches, and can be furnished to fit those of any other capacity. It has been on the market for but a comparatively short time, yet it is being used by many of the important electrical operating companies throughout the United States.

Our Front Cover This Week

Our front cover this issue shows a modern and uptodate Middle-western surface plant. It was installed by the Roberts & Schæfer Co., of Chicago, for the Grand River Coal & Coke Co., at the latter's new operation, Cainsville, Missouri.

When this mine was opened it was intended to have a capacity of about 2000 tons a day of eight hours. The plant was therefore equipped accordingly and designed with special reference to economy and maintenance of operation with careful regard to the preparation of the coal. It was expected that the product would come in competition in the markets west of the Mississippi River and with Illinois coal which is prepared with great care for the domestic trade. To meet this competition the tipple illustrated was built and the four-track shaker screens installed together with many contrivances for rescreening the coal and lowering the large sizes carefully into the cars. The success with which this was accomplished is well shown by the four cars of screened coal in the illustration upon which no comments are necessary.

The hoist consists of a pair of Touhill first-motion engines of ample size to handle the maximum tonnage of the plant. It is housed in a cheap, but substantial frame building covered with corrugated steel. The boiler plant is an induced draft equipment, designed especially for burning the slack coal from the mine, which is brought to the boilers in a conveyor directly from beneath the screens.

The ventilating plant is one of unusual merit, using the Miller Central Disk Fan manufactured by the Eagle Iron Works of Des Moines, Iowa. This fan is housed in a substantial brick building making the whole installation practically permanent and fireproof.

We are indebted to the Roberts and Schaefer Co., for the illustrations and data used in this article.

Coal Discovery in China

According to a report in the native press, a large seam of coal was exposed recently by a landslip in Fung Shun district. The bed is said to be quite thick and of good quality. A company is reported to be in process of organization to work it and it is probable the stripping method will be used.

This report is of interest chiefly as indicating the extent of the coal deposits in the district. The landslip occurred in the same range of hills as are the Kaying deposits, regarding which reports have been made from time to time, but about 75 miles south of the Kaying workings.

The Panther Valley Mining Institute

Preparation of Anthracite Coal

By S. V. Tench*

Two papers, on the preparation of anthracite and on electrical bonding in mining, presented at the recent meeting of the Institute. Both deal with pertinent subjects and the latter presents some valuable data on the loss of efficiency due to inadequate bonding together with original suggestions for overcoming same.

While the impression prevails among the uninitiated that the preparation of anthracite coal is confined to a large, dark, dirty structure known as a "breaker," we who are familiar with the coal game know that such is not the case; but even many of us fail at the same time to realize what a misnomer the word "breaker" is, every effort being made, on the contrary, to prevent the breakage of coal, with its subsequent loss in value.

Being low in volatile combustible matter, anthracite burns most successfully when nearly of a uniform size, this permitting the easy passage of air through the voids. This accounts for the large number of sizes into which the coal is separated.

In this section of the hard-coal field the dominant factors in the preparation of the coal are the presence of a large quantity of rock, (pieces often running up to as high as 800 lb. in weight), and the comparative freedom from "bone" in the coal. The high proportion of big rock in the run-of-mine coal is responsible for a type of breaker construction which does not obtain in the northern and middle fields. The low proportion of "bone" practically reduces the problem, in many instances, to one of eliminating the rock.

In general, the preparation plants here consist of two distinct buildings; the head house and the breaker proper. The function of the head house is to remove all the large pieces of rock and as much small rock as possible down to and including that of steamboat coal; also to make the product of suitable sizes and otherwise prepare it for reception in the breaker. The head house coal is carried to the breaker, as a rule, by conveyors of either the scraper or carrier type. These are usually inclined, in order to gain the necessary height at the breaker end, and are frequently 250 to 300 ft. in length. All jigging, final sizing and picking of the coal is confined to the breaker.

Different Methods of Preparing

Under the well-known conditions of the anthracite field, the general methods of preparation may be summarized under three classes: First, Dry Preparation; secondly, Dry and Wet Preparation, and thirdly, Wet Preparation; the quality of the coal mined governs the class of preparation to be adopted. In our particular region, owing to the high percentage of rock and impurities to be removed, wet preparation obtains throughout.

Dry preparation is used when the seams mined are dry, or practically free from impurities, or where the benches of slate cleave free from the coal, and may be removed by hand, also when the run-of-mine contains, generally, not over 7 to 8 per cent. of rock or slate, which may be removed by hand-picking, or by dry mechanical separators.

Dry and wet preparation is practiced when the run-of-mine contains a high percentage of impurities, including rock, slate and bone. This may run as high as 55 per cent., but the run-of-mine must contain large lumps of pure coal, which can be handled as a separate product, as in the first case. The smaller sizes are sized and cleaned with water to improve their appearance; the impurities are removed by jigging.

Wet preparation is adopted when the run-of-mine is high in impurities and shows a discoloration, as is the case near the outcrop of the coal, or when the entire product comes from wet, dirty seams.

Dry preparation presents the ideal breaker, since it has the advantage of low first-cost, operation and maintenance. Moreover, shipments of dry coal are desirable to the trade, on account of the small percentage of impurities and the elimination of the risk of freezing in cars, with the subsequent trouble of unloading.

Breakers designed for both dry and wet preparation retain to some extent the advantage of dry coal plants, but are higher in first-cost, operation and maintenance than either dry or wet preparation installations. Breakers designed for wet preparation permit of no dry shipments, and are higher in first-cost, operation and maintenance than a dry preparation plant.

The Breaker

Fresh-mined coal is elevated to the head of the breaker and dumped into a large hopper or dump, from which it is fed, by either a hand-operated gate or a mechanical feeder over a sizing-screen, or a set of stationary or oscillating bars, which removes the lumps, allowing the smaller sizes to fall through for further sizing and cleaning. The undersize is usually termed the "mud-screen" product. The lump coal is inspected on a moving picking-band or table, or in an inclined gravity chute, and the pure rock or slate removed by hand. Pieces of rock to which coal is adhering are placed on a special table, where the pure coal is chipped loose and returned, the rock going to a rock chute. Pieces of doubtful or "bone" coal are also removed and sent to be prepared with the mud-screen coal.

All coal that has passed over the picking-head, or platform, is free from impurities and is termed the pure-coal product; after inspection it is delivered either into a lump-coal storage pocket for shipment, or into a set of crusher rolls to be broken into smaller sizes. The No. 1, or crusher rolls, break the lump into steamboat or broken and smaller grades. If there is no sale for steamboat, broken or egg, these classes, after sizing over screens, are passed through a set of rolls, which break them to stove and smaller. The entire pure-coal product is now screened into its various sizes and delivered to the loading pockets, ready for shipment.

The mud-screen product is carried over a second set of screens, which size out steamboat and broken coal. These two sizes are cleaned of impurities either by hand-picking on a stationary or movable table, or by mechanical means, and are then either shipped, or re-broken into smaller sizes. In the latter event, the cleaned steamboat or broken coal is mixed with the pure-coal product and prepared with it. The mud-screen product falling through the "broken" screen is separated into the various sizes, each of which is treated to remove the impurities before going to the storage or loading pockets.

The method of cleaning varies from hand-picking for the larger sizes, to a mechanical separator, dependent for its action on the difference in the coefficent of friction between the coal and its impurities when sliding over a smooth surface, or the jig, the theory of which is based on the different specific gravities of the coal and the impurities.

After sizing and cleaning, the coal runs to the storage pockets. Afterwards in loading it into cars for shipment, the fine dust and screenings (generally made in gravitating the coal in chutes from the screens into pockets, or by mechanical handling) are removed by passing the product over a punched-steel plate or a woven-wire segment called a lip-screen. That passing through the lip-screens is elevated to sizing screens, re-sized and returned to the pockets. After loading,

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the coal is again inspected to make sure that it will pass a standard test for size and purity. If it fails in this inspection, it is condemned, unloaded and again prepared. It is, therefore, necessary in designing the breaker to provide machinery for treating the condemned coal.

There is today a marked tendency toward more rigid standards of inspection at the collieries and a consequent prominence to the subject of rehandling condemned coal. Exact figures of general interest in this connection are hard to obtain, but it may be easily observed that rehandling condemned coal is likely to be an expensive operation unless it is possible to pass it through the breaker during the same time it is handling run-of-mine.

Disposal of the Refuse

All the breaker refuse, slate, bone or rock, removed during preparation is carried to a central point for final disposition. Two general methods are employed for this purpose: First, the waste is deposited on the surface in banks, by means of a chain or belt conveyor, dump cars and planes, mechanical haulage, or with mules. Secondly, it is returned into the mines to fill the openings left by the extraction of the coal.

The latter method called "silting" is accomplished by crushing the refuse to a size which will pass through a 1.75-in. ring, and hydraulicking it into the mines through wooden or metallic pipes. While this method is used extensively in the upper anthracite regions, it is not practicable in this district on account of the thick seams and heavy pitches which make it impracticable to construct batteries of sufficient strength to sustain the tremendous pressure of the refuse and water that must necessarily be used to slush the old workings. The scheme has been successfully tried, however, in some parts of the lower anthracite region, but only in the thin seams.

The disposition of refuse on the surface, by means of a conveying system, is to be recommended when dumping ground is available adjacent to the breaker. Banks can be carried to a height of 100 ft. or more and extended in length by means of additional horizontal conveyor lines. The use of the dump car is advocated when the breaker is not tributary to the refuse bank; but this method is more expensive in operation, (and generally in first cost) than the former.

The second method, silting, is employed when dumping room on the surface is limited or unavailable, and has the advantage that it adds to the stability of the remaining pillars and helps to support the roof of the mine. It is simple and cheap in operation, providing there is an ample water supply at low cost; but a complete installation is more expensive than that of a conveying system, if the cost of the pump and appurtenances, necessary to rehandle the silt water from the mines to the surface, is included.

Special Chutes for Eliminating Breakage

The accompanying standards of preparation are in vogue generally throughout the anthracite-coal field. The table allows a percentage of bone in addition to slate, in the coal; bone being defined as a product containing between 40 and 55 per cent. carbon.

A matter which is probably receiving more attention than any other one thing in connection with the subject of coal preparation in this district, as well as in other parts of the anthracite field, is the prevention of breakage in the chutes. Nearly all of the larger companies are continually experimenting on different forms and styles of chutes with various results and varying degrees of success.

Lehigh Coal & Navigation Co's Standard of Preparation

(Values in Per cent)	Sizing		Refuse	
	Larger	Smaller	Slate	Bone
Broken			20*	20*
Egg	5	20	2	2
Stove	5	20	4	3
Chestnut	5	15	5	5
Pea	5	20	8	
No. 1 Buckwheat	10	20	10	
No. 2 Buckwheat	10	20		
No. 3 Buckwheat	10	25		

*Pieces.

One of the chief difficulties in connection with the building of a permanent chute, is the fact that the quality of the coal is likely to vary from wet to dry and from clean to dirty, in the sense that a large proportion of fine coal constitutes dirt as well as a large proportion of impurities. The same pitch of chute is not suited to both conditions, and in consequence the clean dry coal will likely go down hard, while the wet, dirty coal lags on the way.

To a limited extent, this difficulty has been overcome here, as elsewhere, through the use of retarding chutes, which allow the pieces of coal to expend their acquired momentum at frequent intervals by sliding up a slightly adverse pitch. These chutes are constructed in zigzag fashion, with comparatively short straight runs, and when built with enough pitch on these runs to suit the slowest coal likely to traverse them, they have been giving excellent results here within certain limits.

The detailed methods of sizing, jigging, crushing, picking and transporting coal in and through the breaker, with comparisons as to the best practice under our particular conditions have not been touched upon, but will furnish material for a later paper.

The Utilization of Discarded Hoisting Ropes as a Return for Electric Circuits

By Albert Leonard*

For electric mine and industrial haulage, a direct current of 250 volts is generally used. Much higher voltages in mines is inadvisable, due to places where the accidental touching of live wires cannot be prevented. The disadvantage of a low voltage of 250 consists in the heavy currents which have to be handled, and which require heavy conductors in order to keep the line losses within practical limits; the investment for such conductors is considerable.

The electric generator or substation at the mines generally produces a potential of 275 volts, which is required to force the current through the copper feeder system, through the electric mine motors, and back the return track. Part of this voltage is required to overcome the resistance in the copper feeder and return track, and is not available for useful work in the electric motors.

In electrical work, a certain loss on account of the resistance of the conductors cannot be avoided, but this resistance may be fixed to a value where the maximum economy will be obtained. The resistance of an electric circuit varies with the kind, length and sectional area of the conductors. The magnitude of the current depends upon the load of the motors. The loss in the circuit in volts, is the product of the current in amperes times the resistance in ohms. The resistance may be varied in order to bring the loss to a value where it is not considered excessive. The size of the conductors depends upon local conditions such as the load on the motors and extensions in the mines, and each case must be considered individually.

For the transmission line in mines, a good-sized trolley wire is generally selected in order to have the required electrical conductivity and mechanical strength, and to reduce the necessity of putting in extra feeders. A trolley wire of No. 0000 B. & S. gage or about $\frac{7}{16}$ in. diameter is generally used. It has a resistance of about $\frac{1}{4}$ ohm per mile, and with a current of 100 amperes on a one-mile line, the loss in the trolley wire alone would be $100 \times \frac{1}{4}$, or 25 volts.

Losses in Return Circuits

In addition to this, is the loss in the main cable from the substation to the shaft or tunnel where the wire is connected, but the loss in the return track is of still greater importance. The resistance of the latter depends upon the resistance of the rails and rail joints.

The specific resistance of the rails varies considerably according to the com-

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position of the material and may be from 8 to 20 times that of copper. For this reason, it is advisable in specifying rail, to consider its electrical conductivity. A ratio of 10 to 1 for specific resistance of steel rails to copper may be considered good practice, and under these conditions, a 40-lb. rail will have about twice the conductivity, or one-half the resistance of a No. 0000 trolley wire; and, if electric contacts between the rails were made equal to the full rail material, the resistance of one rail per mile would be one-half that of a No. 0000 trolley wire or ⅛ ohm, and the loss with 100 amperes will be 100 × ⅛, or 12.5 volts. With two rails connected under the same conditions, the loss is 6.25 volts, or one-fourth of the loss in the trolley wire. The current of 100 amperes is used as a matter of convenience and varies according to conditions, and with it the loss in the circuit.

The electrical contact of the rails produced by fish plates is unreliable and is generally of high resistance, especially when the contacts are not clean and the fish plates loose. In some cases the resistance is close to an open circuit so that the current has to find its path through the ground, water or air pipes, which also have a high resistance. The excessive resistance of the rail joints is overcome by bonding. There are different kinds of bonds used according to local conditions, and for use in mines the flexible compressed terminal bond is best suited.

To be efficient, the bond must be applied in a workmanlike manner. Good contact is one of the most important features in electrical work, and especially in bonding, where so many connections have to be made. A few poor bonds, especially when close to the power supply, will reduce the efficiency of the haulage considerably. The result is: Loss of time; unsatisfactory working of the motors; heavy repair bills; electrolytic action on air pipes, etc. And to overcome these losses, larger generating stations are required.

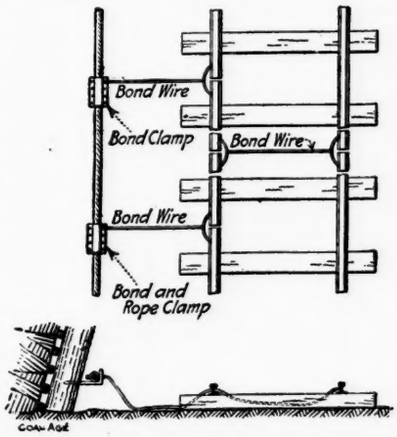
Where favorable conditions exist, as on the outside, or where tracks are new and the rails in first-class condition, a bond of high efficiency is obtained and kept in good condition at a reasonable expense. In mine work, conditions are not in many cases so favorable and it is generally more difficult to do good bonding. Contacts must be smooth, clean and dry, and, even if the bonding is done right, it is hard to keep up the efficiency, since rails are frequently changed or bonds cut by cars getting off the track. For these reasons the results obtained are not what should be expected for the money invested.

Ground Wires

The only way to overcome this unsatisfactory condition and to reduce the bad effects to a minimum is to put in ground wires along the track and to tap these, at suitable distances, to the rails; this insures the bonding and provides an uninterrupted metallic circuit. The high price of copper practically prohibits its use for this purpose.

Wornout wire hoisting ropes, in lengths of 500 ft. and over, which makes few joints necessary, having a scrap value of approximately $8 per ton and a specific resistance of 8 to 1 as compared with copper, may be utilized for this purpose. It is a better conductor than rails and a rope of, say, 1½ in. diameter has about the same current-carrying capacity as a No. 000 B. & S. gage, or about a ⅜-in. copper wire. Smaller ropes may also be used, the size required depending upon the conditions.

The wire rope may also be used where ground wires are required, as between substations and the mines. For this work, copper cables 1 in. in diameter are quite frequently used. An installation requiring 1000 ft. of such copper cable would cost approximately $550, and the same



Sketch Showing Method of Bonding

result would be obtained with wire rope at a cost approximating $100. For such outside work 1¼-in. and 2-in. ropes, which cannot be handled very well inside, may be utilized. The installation should be made in the following manner:

From the substation to the entrance of the mine, where no rails are used, 1¼-in. or 2-in. rope, either single or in multiple, according to the load on the circuit and the distance, should be used. Along the track in the main gangway 1½-in. rope, and for extensions 1¼- and 1-in. single ropes are suitable. The rope is stretched out by attaching it to a mine motor or locomotive and in this manner several thousand feet may be laid in a few hours. As the ropes are seldom shorter than 500 ft., only a small number of joints, which should be made with substantial 10-in. clamps, are necessary. Sheet lead lining should be used between the clamps and rope, thus providing a reliable contact. One of the bolts used with the clamps serves as a bond terminal. Where the rail taps make connections with the ropes, smaller clamps are used at distances of about 200 to 300 ft. It is advisable, in order to increase the durability, to put the rope on the high side of the track to keep it out of the water as much as possible.

Some Practical Results Obtained

The efficiency of the return track, either single or double bonded, and provided with such a ground wire, will be very little affected by a few defective bonds, and the practical results will be far superior than with the regular bonding only. On account of the stable conditions obtained with the ground wire, in many cases single bonding with some cross taps between the rails will be sufficient; where distances are short and the load light, satisfactory results will be attained by the ground tapped to the rails at suitable distances without the regular bonding. The inspections and repairs of the track in regard to bonding will also be reduced to a minimum.

At one of our operations where three 8½-ton electric mine locomotives were working there was considerable complaint due to the inefficiency of these motors and in fact a request was made for an additional motor. I made a personal examination of the place and found that there was lost time for power, a large amount of sand was being used on the track and trolley wheels did not last longer than a day or two. The track at this operation was laid with 40-lb. rail at the bottom of the shaft and 30-lb. rail in the gangways. The bonding was about equal to the average condition of bonding in mines.

I installed, as promptly as possible, 7500 ft. of wire rope, 2000 of which was 1½-in., 4000 1¼-in. and the balance 1 in. in diameter. The results were entirely satisfactory. The motors now in use are doing good work, the amount of sand used on the track has been reduced 65 per cent., which also reduces to a minimum the wear on the motor wheels. There is no further complaint regarding power or poor trolley wheels. It is to be regretted that, in order to make the installation promptly, no tests were made before and after; however, I am making tests on similar installations being made at the present time, and expect to continue these on future work, and it is expected that the results will show a considerable saving.

Erratum

The last paragraph, second column, page 659, of our issue of Nov. 9 should read "C. Dorrance, fuel engineer of the L. C. & N. Co., stated that an increase of 1 per cent. in the *domestic* sizes meant an annual saving of $75,000 to the company."

Current Coal Literature

The Best Thought Culled from Contemporary Technical Journals, Domestic and Foreign

Hanging Troughs for Protecting Trolley Wires

Claude T. Rice, in a recent issue of the *Engineering and Mining Journal,* makes the following remarks on the protection of trolley wires:

"At Bisbee, mine men have been killed by contact with 230-volt alternating-current, as well as with 220-volt direct-current circuits. The amperage in both cases was high as the wires were on the power line. On investigation, the doctors attributed both deaths to the weak hearts of the victims.

"In Missouri a miner was killed by grasping one of the wires of a three-phase, 220-volt, alternating power circuit. He was showing a man, who was warning him of the danger, that the wires were perfectly harmless. In this case, it was surmised that a ground from the wire of the other phase existed near-by, so that the miner really got 440 volts.

"It is of the utmost importance that miners realize the danger of these high-amperage circuits, for men have and are being killed by wires carrying only 220 or 230 volts. To guard against such accidents, some form of trolley-wire protection is necessary. This usually takes the form of a trough, the sides of which extend down below the wire and keep men from touching it with their bodies or with the tools which they may be carrying on their backs. At chutes the danger is especially great, but as it costs only little more and makes the workings far safer to extend the trough protection throughout the mine, the wire should be protected.

Diagonal Plugs

"Three different methods for supporting the protecting trough have been suggested. The cheapest is probably a modification of the system used to carry the insulators at the Mascotte tunnel, Bingham, Utah. Here, with stoping drills, two inclined holes are drilled into the roof of the heading. These holes are 12 in. deep and 2½ in. in diameter. Pegs measuring 4x4 in. are sharpened to fit and are driven into the holes. As these two pegs slope away from each other, the trolley trough would be securely held to the roof if it were nailed directly to their squared heads, as shown in the accompanying drawing, Fig. 1. This method is of value when the roof is of uniform height, so that long plugs are not necessary to keep the trolley board approximately level.

Split Steel Plugs

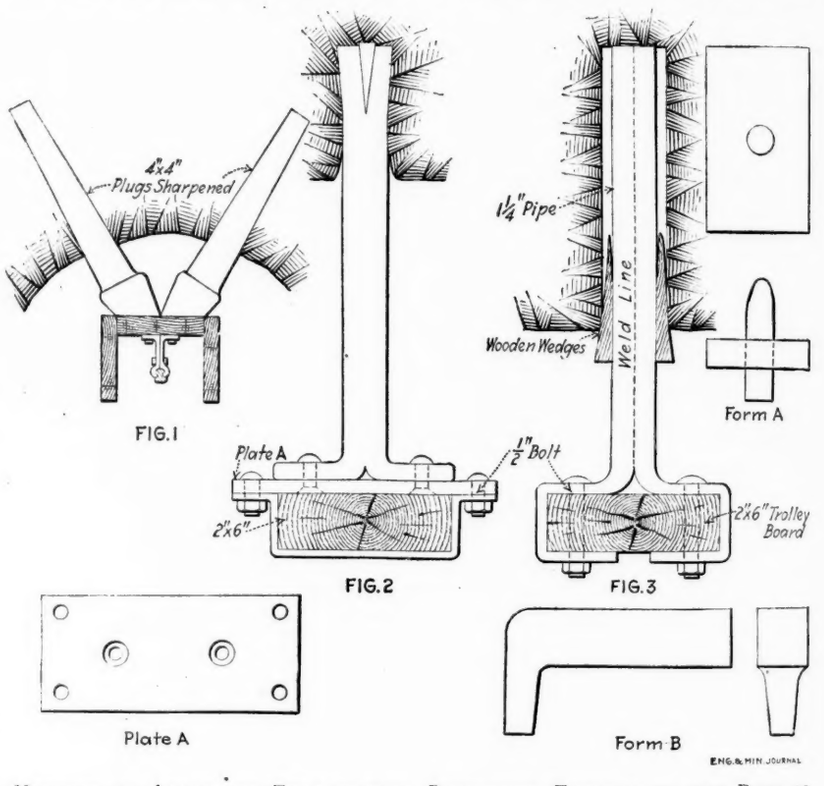
"A better method adaptable to all roofs is that used at some of the mines of the Cleveland-Cliffs Iron Co. in the Lake Superior district. Here steel pins are fastened in vertical holes by a wedge driven into the split inner end of the pin, as seen by the accompanying drawing, Fig. 2. The outer end of the pin is also split and bent out to form wings. These wings are flattened and to them is riveted a ½-in. plate carrying four holes through which pass ½-in. carriage bolts, which support the straps carrying the protecting trough.

"The plate is made wide enough for four bolts, so that the troughs may be spliced at the pins. It is just as well, however, to splice them with top or side cleats and so have the wings carry the straps directly without the intervening plate. This makes a strong hanger where the trough has to be carried at some distance from the roof, and it is a good way to use up old drill steel.

Plugs Held by Wood Wedges

"At the Cliff shaft of the Cleveland-Cliffs Co., a somewhat less expensive hanger has been devised by Lucien Eaton, superintendent of the Ishpeming mines. Pieces of 1¼-in. pipe are fastened by wooden wedges driven on opposing sides of the hole, as shown in the accompanying sketch, Fig. 3. The holes are drilled 10 in. deep. The outer end of the pipe is split, one cut following the weld. This end is then spread out and the wings flattened on forms.

"The first form, marked *A,* consists of a flat piece of iron 1 in. thick, 4 in. wide and 6½ in. long. A pin at the center of the form projects both above and below the plate; the top end enters the split part of the pipe, while the bottom end is shaped to enter the hardie hole of the anvil, thus holding the form in place. The wings of the pipe having been bent down and flattened are turned precisely at right angles over the ends of the form. The pipe with the wings still hot is now completed on a second form, marked *B.* This is merely a 2x2-in. bar of iron with its



Methods of Attaching Trolley-wire Protection Troughs to the Roof of the Mines

end bent down and shaped to enter the hardie hole. On this form another right-angle bend, back toward the center of the hanger, is made in each wing.

"In this way a 6½x2-in. yoke is formed to receive the top board of the trolley trough. The yoke is bored for two ½-in. bolts, one on each side, by which the 2x6-in. trolley boards are securely fastened. With this system the boards are spliced by the side pieces of the trough or by a top cleat. By the use of forms a uniform size and shape of hanger is insured and much time is saved in the blacksmith shop. A good blacksmith can easily make ten hangers per hour.

"As all scrap pipe and short lengths which are in a fair condition, can be utilized, the hangers are relatively cheap and, unless unduly long, are quite strong enough. Measurements are taken at the different points along the heading and the hangers are sent in numbered. Thus each is suited for the location in which it is to be placed, its lengths being proportioned so that the trolley will run at approximately the same height throughout the mine.

"Not only does the trough protect the workingmen who travel along the road where the wire is in use, but it also serves as a guide to the trolley pole. Should it jump the wire, the trough protects it from injury. The Cleveland-Cliffs Co. does not use a trough along the entire line. It merely attaches the top board to carry the insulators. Troughs are used only where there is much travel, and near chutes."

Gas Ignition by Electric Sparks

By W. M. Thornton*

This article treats on the ignition of gas by a spark from a breaking conductor. The author shows that copper signaling wires, carrying 20 volts of direct current, cannot ignite gas on parting but iron wires may, if the current is 4.5 amperes or above. The current to be carried by a wire can be increased proportionately to its diameter. Inductance in the circuit increases the risk of ignition.

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Note—Paper read before the North of England Institute of Mining and Mechanical Engineers.

The conditions under which explosive mixtures of certain combustible gases and air can be ignited have been fully examined for the requirements of the theory of the gas engine. In most cases, the ignition has been originated, either by contact with an incandescent wire, or by a stream of sparks from an induction coil at a frequency of several thousand a second, forming in effect a maintained arc.

The investigation sought to discover how ignition could be obtained when a continuous or nearly continuous discharge of electricity took place. The opposite condition is in question in regard to the use of electricity in mines. We desire to know under what conditions, single electric sparks may fail to ignite mixtures of gas and air. This is a question of the first importance in regard to the safe use of electricity in coal mining.

The Possibility of Ignition by Signaling Wires

The new British Coal Mines Act of 1911 prohibits the use of electricity where more than 1¼ per cent. of gas may be present, and limits the pressure to 20 volts in signaling circuits where the bare wires used may be brought together.

It seemed well, therefore, to re-examine the entire problem of the ignition of gas by single sparks, such as may possibly arise in mining practice. Particularly was it desired to ascertain the conditions controlling the ignition of gas by wires at signaling voltages. Special consideration was given to the influence on ignition exerted by voltage and gas percentage and to compare the relative safety of direct and alternating current.

The most usual causes for "open sparking" are the breaking of a power cable by a fall of roof or a momentary or vibrating contact between signaling circuits. In all these cases, the final separation is between points of metal.

The simplest way of obtaining a spark between metals, from a point which may be renewed, is by making contact between two round wires touching at right angles. The arrangement of these and

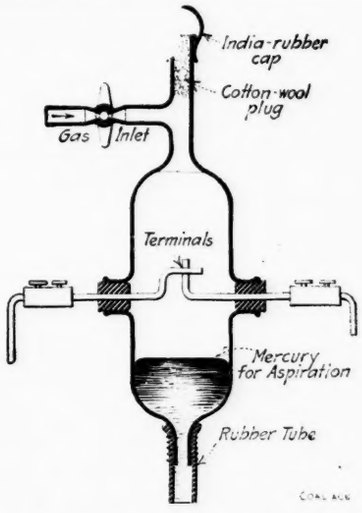


Fig. 1. Vessel for Determining Safe Electric Currents in Gas Mixtures

of the "explosions vessel" used is shown in Fig. 1.

Description of Apparatus

This was made of well annealed glass, 5.5 cm. in diameter, and had a volume of 300 c.c. The vertical exit tube at the top was fitted after each explosion with a plug of cotton-wool, the mercury then raised to the level of the inlet, the air in the pipe fully swept out by gas from the reservoir, the top of the tube closed with the finger, and the explosive mixture drawn in by lowering the mercury.

After the chamber had been filled with gas, the vertical tube was further covered with an india-rubber cap, which prevented diffusion and blew off easily at ignition. The terminals of the wires could be rotated by hand through an arc of 90 deg. and the speed of separation was found by trial to be nearly the same throughout, namely 3.5 radians per second (1.8 revolutions per second). A metronome set to a convenient frequency served to give uniformity in the make and break when desired.

The rods used were of iron, copper and nickel, the first, to represent the conditions of signaling wires in mines, but to cover also the case of armoring in possible contact with live conductors, the second, to parallel the breakage of a conducting wire, and the third, chiefly as a control. No attempt has been made to imitate precisely the kind of break likely to occur in practice.

Some idea of the work entailed may be drawn from the fact that, to determine each point recorded on the curves, an average of 600 breaks were made so that in all over 50,000 tests were used to determine the results to be described in this article.

In the earlier stages, there was no guide as to the igniting current to be expected under any given conditions of voltage and mixture. The procedure was, therefore, to guess at a current and to make a hundred contacts in succession. If no ignition occurred, the current was raised and the trials repeated.

When a current had been found which gave ignition after the first few contacts, this was considered to be too high. The limiting igniting current was taken to be one which fired the gas within fifty sparks slowly repeated. For part of the time, mica vanes were attached to the wires,

in order to insure circulation of the mixture in the explosion-vessel, but this had no perceptible effect on the limiting current.

The conditions under which single sparks may ignite gas are so difficult to control that a current of say 3.30 amp. might cause an explosion at the third, 3.35 at the thirtieth and 3.4 at the eightieth, and any two of these might change places.

Near the critical current many trials were made with fresh charges of mixture, ten or more in difficult cases.

In endeavoring to ascertain the conditions under which single sparks may ignite gas, reliance is placed on the average from a great number of trials, and upon having the contacts in as nearly the same condition as possible throughout, as to polish and state of surface.

As it was difficult to obtain pure firedamp in large quantities, the first ignitions were made in a mixture of coal gas and air.

Part of the work was done during the coal strike and the composition of the gas

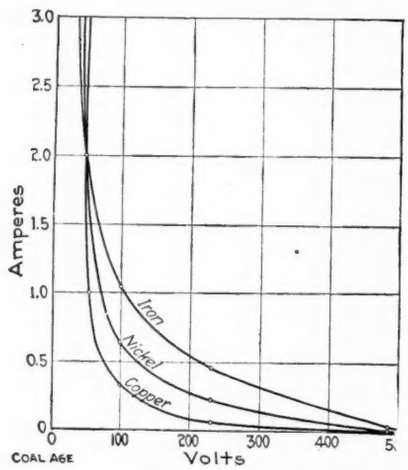


FIG. 2. LEAST DIRECT CURRENTS IN NON-INDUCTIVE CIRCUITS WHICH IGNITE AN 11-PER CENT. MIXTURE OF COAL GAS AND AIR AT VARIOUS VOLTAGES

used was modified by the extensive use of "water gas"; the calorific value was, however, little less than that of the normal supply. Only the results with nickel poles are materially affected by the change, as will be shown in a later issue. The gas used prior to the strike was of the following composition:

COMPOSITION OF COAL GAS USED

Gas	Per cent.
Carbon dioxide	0.0
Oxygen	0.1
Olefines	3.9
Carbon monoxide	5.3
Methane	34.2
Hydrogen	47.1
Nitrogen	9.4
	100.0

INFLUENCE OF VOLTAGE

The first ignitions were made in a mixture of coal gas and air. After some preliminary trials, it was decided to use eight parts of air to one of gas, making what was roughly an 11 per cent. mixture. It seemed better to do this than to use the more sensitive mixtures containing about 9 per cent. of coal gas, for it was expected that there would be a rapid increase in the current necessary for ignition if the percentage of gas was greater or smaller than in the most sensitive admixture of gas and air. This variation was later shown to exist as can be seen in a succeeding issue.

The interval of time between the moment of ignition and the establishment of the maximum pressure of explosion is also less in 11 than in 9 per cent. mixtures. When making tests with direct currents, large storage cells were used for obtaining voltages not exceeding 50, but for electric pressures above this, a machine furnished the needed current. The resistances inserted were non-inductive in every case and consisted at the higher voltages of banks of lamps.

The results are given in Table I, in which the columns marked "inductive" are for circuits having an inductance of 0.0025 henry added, this being approximately that of an average signaling circuit. The figures marked with the symbol >, expressing "greater than," indicate that no ignition took place when the amount of current was as large as could be used without burning the contacts badly.

The noninductive tests are illustrated in Fig. 2. In view of the known shortness of the range of percentage of methane in which ignitions are possible, it was decided to make all trials with that particular mixture of methane and air which gives complete combustion, namely with 9.36 per cent. of the former. The results of the experiments are given in Table II.

TABLE I. LEAST DIRECT CURRENT, IN AMPERES, WHICH IGNITED AN 11-PER CENT. MIXTURE OF COAL GAS AND AIR ON BREAKING CIRCUIT. ATMOSPHERIC PRESSURE; TEMPERATURE, 18° TO 20° CENT.

	Iron Terminals (Diameter, 0.075 in.)		Copper Terminals (Diameter, 0.065 in.)		Nickel Terminals (Diameter, 0.05 in.)	
Volts	Non-inductive	Inductive	Non-inductive	Inductive	Non-inductive	Inductive
12	16.00	7.50	.....	.....	.....	....
20	5.00	4.50	>20.000	>20.000	>20.000	....
50	2.04	2.00	1.050	1.000	2.200	2.10
100	1.15	0.95	0.350	0.250	0.600	0.75
240	0.42	0.40	0.030	0.020	0.220	0.35
480	0.12	0.10	0.025	0.016	0.025	0.18

TABLE II.—LEAST DIRECT CURRENT TO IGNITE A 9.36 PER CENT. MIXTURE OF METHANE AND AIR. ATMOSPHERIC PRESSURE; TEMPERATURE 18° CENT.

	Amperes		
Volts	Iron Terminals	Copper Terminals	Nickel Terminals
50	4.00	4.000	4.00
100	1.05	0.900	1.15
240	0.40	0.175	0.55
480	0.10	0.050	0.15

It will be seen by these two tables that at the higher voltages, the current required for ignition with iron terminals is greater than with nickel or copper, but at voltages such as used for signaling, the current needed is less. This it will be seen is equally true whether the mixture taken is the most explosive mixture of methane and air or is of coal gas and air so proportioned as to give a minimum "time of explosion." With iron terminals, as is seen by comparing Figs. 2 and 3, the least currents needed to ignite both the gas mixtures are almost the same for equal voltages between 100 and 480 volts.

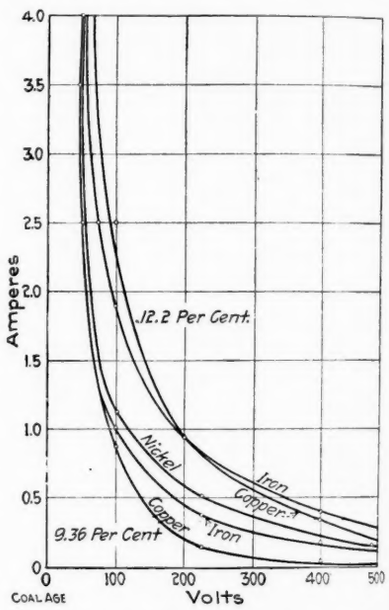


FIG. 3. LEAST DIRECT CURRENTS IN NON-INDUCTIVE CIRCUITS WHICH IGNITE MIXTURES OF METHANE AND AIR AT VARIOUS VOLTAGES

TWENTY VOLTS GIVE ALMOST ABSOLUTE SAFETY

As the voltages are decreased below 50, the currents which it is necessary to pass through the wire to insure ignition on its breaking, increase with great rapidity. It would appear to be impossible to ignite even the most explosive mixture of methane and air by single break sparks from a signaling circuit at the maximum voltage of 20, which is allowed by the British Coal Mines Act

At these low voltages, electrical signaling may be used with safety in any part of a coal mine, provided that care is taken to prevent wires from remaining in contact, thus forming a short-circuit. Such a contact would cause the wires to become red hot where they touch. But this is unlikely to occur.

The bells should be of the single-stroke type; bells constructed on the trembler design are not safe in gas, unless the sparking contact is inclosed in an explosion-proof case.

Influence of Diameter of Terminals

Fig. 4 shows the relation existing between the sizes of the wire used and the least current, which will cause an ignition of coal gas or methane in air. The igniting current is a linear function of the diameter; in coal gas nearly proportional to it, the lines intersecting the vertical axis of coördinates at about 0.5 ampere.

In methane, the rate of change of current with diameter is the same for all metals at 75 volts, but the line showing the current change cuts the vertical axis at 1.5, that of copper at 2.2, while the nickel line cuts it at 2.6 amperes. At lower voltages, iron and nickel change places in order of activity.

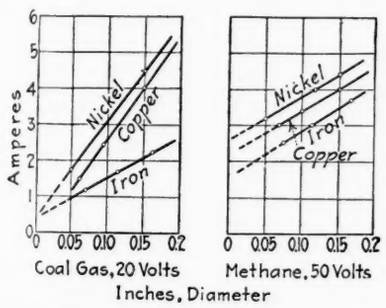


Fig. 4. Relation between Least Igniting Current and Diameter and Material of Terminals

Influence of Inductance

Inductances measuring 0.0025 to 1.35 henrys were placed in a 20-volt circuit and the resistance adjusted until the current just failed to ignite the 11 per cent. mixture of coal gas and air. Small copper terminals were used with the results noted in Table III.

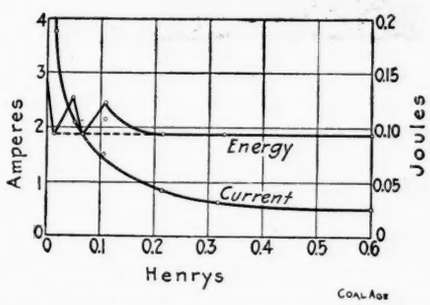


Fig. 5. Relation of Induction to Least Current Which Will Ignite Coal Gas and to Energy of Spark

TABLE III.—INFLUENCE OF INDUCTANCE ON IGNITIONS. 11-PER CENT. MIXTURE OF COAL GAS AND AIR; VOLTAGE 20; DIRECT CURRENT

Inductance, in henrys.....	1.53	0.76	0.325	0.217	0.108	0.069	0.056	0.013
Least igniting current, in amperes.....	0.27	0.5	0.75	0.93	1.4	1.65	2.05	3.75
Energy of arc, in joules....	0.06	0.091	0.091	0.093	0.10	0.09	0.12	0.09

The curve representing these results is shown in Fig. 5, together with the energy of the arcs. The risk of ignition increases rapidly as the inductance is raised, and no direct-current signaling circuit could be regarded as safe with a total inductance of 0.1 henry.

In practice they have, as a rule, much less than this, and a typical mining signaling circuit connected through the explosion chamber failed to show any signs of igniting the most explosive mixture of coal gas and air, when the contact was broken in it. The maintained spark at the spring contact in a trembler bell is known to ignite gas.

Energy Needed to Start Explosion

The curve of the least energy required to ignite the mixture is interesting. At the lower inductance there is some variation, but the energy remains nearly constant at about 0.10 joule. We have here a measure of the electrical energy required to start a gaseous explosion by arcs of short duration.

It is in thermal units about 0.025 small calories, equivalent to the combustion of 4.1 c.c. of coal gas, or of 37 c.c. of an 11 per cent. mixture. At the highest inductance the energy was less, corresponding to the combustion of 21 c.c. of mixture.

It is agreed that the cause of the delay observed in all gaseous explosions is the slow combustion of a certain volume of gas before enough heat is set free to enable the mixture to ignite itself; but there can be no doubt that the ignition of only a few cubic centimeters—in a test tube, for example—will suffice to start an explosion. A similar pause is observed when coal dust is caused to explode.

There are several other matters in connection with ignition of gas by single sparks, which are of much interest; these are the duration of the spark, the percentage of gas present and the use of alternating current.

(To be continued in an early issue.)

The Fery Bomb Calorimeter

Special Correspondence

Before the engineering section of the British Association for the Advancement of Science which recently held its annual convention at Dundee, Scotland, Robert S. Whipple read a paper describing the working of the Féry bomb calorimeter.

"In general design the apparatus is somewhat similar to the well known Mahler instrument but greatly simplified in its details. The bomb consists of a light iron vessel weighing about 1 kg., having a capacity of about 250 c.c., and supported in the center of a brass vessel by two disks of constantan (an alloy of copper and nickel). As the mass of metal in the bomb is small and no water-jacket is used, the rise in temperature of the bomb due to the combustion of the coal is large, averaging about 20 deg. C. when 0.5 gram of coal is burned. With such a large rise of temperature, the measurements need not be made with the same degree of accuracy, as in the case of the usual type of bomb calorimeter, in which the temperature rise amounts to only 2 or 3 deg. C. for the same quantity of coal.

Thermo-electric Method of Determination

"The rise of temperature is measured by the thermo-electric current which is generated by the constantan disks and the iron bomb, the surrounding envelope acting as the cold junction of the thermo-couples. These couples have an electric-motive force of 40 microvolts per deg. C., and on a pointer galvanometer a deflection of 60 mm. for a rise of 20 deg. C. It is thus possible to estimate the temperature rise of the bomb to at least 1-5 deg. C. or 1-300 of the total rise in temperature. The loss of heat from the bomb is due to three causes: (1) Conduction along the constantan disks; (2) convection currents in the air-space surrounding the bomb; and (3) radiation from its walls.

"The coal under examination is placed on a small tray in the bomb, the latter being filled with oxygen at about 200 lb. pressure. The coal is fired electrically and the maximum temperature rise on the galvanometer takes place about 1½ min. after ignition. Experiments show that the gas pressure can be varied from 150 lb. to 250 lb. and the weight of coal burnt from 0.2 to 0.7 gram without any difference in the results obtained. The instrument is standardized by burning sugar, carbon, or standardized coal briquettes, the calorific values of which are known."

Caps used in mine timbering should be of soft wood, pine or hemlock. They should be at least 2 in. thick and 14 to 18 in. long.

Who's Who—in Coal Mining

Devoted to Brief Sketches of Prominent Men, Their Work and Ideas

The Illinois coal operators have always been leaders in the coöperative idea. We strain that word somewhat from its stereotyped connection. Cooperation between mine owners is usually treated to a shorter and uglier word but the frayed confraternity of coal barons have such a need for amalgamation that their joining forces together should excite the good will of the consumer and not his reprobation.

It is G. W. Traer who has frequently been the spokesman for the Illinois coal operators. In his precise English, he has pleaded for a moderate view in regard to coöperation which, as he has shown, makes for conservation of coal resources, of life and of labor.

Mr. Traer was born at Vinton, Iowa, in 1859 and received a high-school education, supplemented by a winter's tutoring in mathematics, land surveying, chemistry and physics.

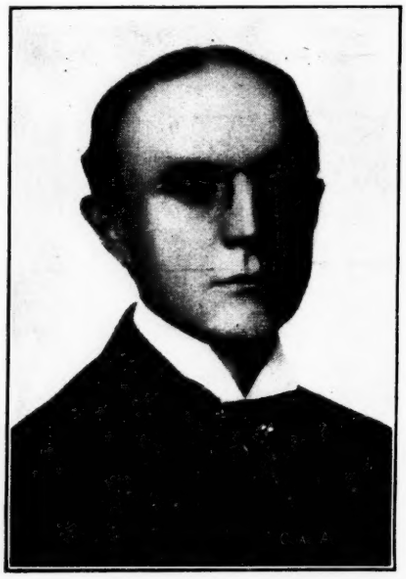
His first work was at the operating key, from which many distinguished men, notably Andrew Carnegie, have risen. After two years at this grind he left it for clerical work in banks at Vinton and Cedar Rapids, and busied himself during four years with receiving and disbursing money.

In 1883 he migrated to Wisconsin, to assist in the building of a railroad up the east bank of the Mississippi. When this company was absorbed by the Chicago, Burlington & Northern R.R., he became the assistant treasurer and had charge of the purchase of right-of-way.

He was admitted to the bar of Wisconsin in 1885, and in January, 1886, he entered a law firm at LaCrosse. This copartnership handled the law business of the C. B. & N. R.R. in Wisconsin and Mr. Traer remained there until late in 1887.

He then went to Chicago as treasurer and purchasing agent of a railroad which was being constructed through the coal fields of northern Illinois for the Chicago, Burlington & Quincy R.R. Upon the completion of this road, he entered the employment of J. C. Osgood, and was engaged in the purchase of a large body of coal lands and in the development of a mine. Thus after a long and circuitous journey, Mr. Traer executed a flank movement on the coal industry.

In 1890, he became treasurer of the Osgood companies in Illinois and Iowa and in 1892 became vice-president also, with jurisdiction over the operating department. In 1896, he became president of



GLENN W. TRAER

the companies and so remained until 1907 when Mr. Osgood sold all his interests in Illinois and Iowa.

Since 1889 Mr. Traer has made careful investigation into the values of coal lands in New Mexico, Oklahoma, Arkansas and Kentucky and briefer but considerable inquiry into the coal formation of nearly all the states in the Appalachian coal field. From Apr. 1, 1907, to Jan. 1, 1909, he had charge of the Illinois Collieries Co. as president and receiver.

It will be seen that Mr. Traer is admirably fitted for that important class of work having to do with the disposal of coal when above ground. Without intention, he has secured the knowledge of railroad work, of financing, of legal practice so necessary for an organizer among mining men. To those who never get away from the reek of the return air, nothing seems important but the delving of coal. Principles of mining, systems of electrifying, modes of lighting, types of transportation fill the mind to the exclusion of other matters.

To a man of Mr. Traer's experience, these problems pall before the business questions, the rate of freight, the methods of financing, the right to fix the price and the territorial distribution of markets, matters somewhat alien to the science of mining but bound inseparably with its successful accomplishment.

We do not wonder that Mr. Traer with his peculiar qualifications was president of the Illinois Coal Operators Association during 1907 and 1908. That he was not a rabid leader in the contests with the men is seen by his reflection among others that discussions of wage scales without heat and rancor may save much misunderstanding of the position of the operator.

In the years 1902, 1903 and 1906, Mr. Traer was chairman of the Interstate Joint Conventions to determine wage scales. Since its organization in 1906, he has been president of the Illinois Coal Operators' Mutual Employers' Liability Insurance Co.

He represented the Illinois Coal Operators before the U. S. Interstate Commerce Committee to which body he expounded his views. In his opinion the number of mines should be restricted by a legalized agreement approved by the Commerce Court.

Every operator should be allowed to sell all the coal he pleases at any price he thinks well, whether his mine works or not. Apparently he is to be allowed to buy the coal at the cost of production. In this way the men would get steady work, no losses due to irregular running would be sustained by the operator or miner and the method of working would be such as is conductive to the safety of the miner and the conservation of the coal.

Needless to say Mr. Traer was marked out for the gibes of the commission. The operator should be all fury in opposing his brother operator, but his love to the working man and the consumer should pass all measure.

Mr. Traer is a member of the Mining Investigation Commission of Illinois, created by the General Assembly of 1909, which commission investigated the Cherry disaster and drafted the Fire Appliance Act for coal mines. This bill was enacted by a special session of the Assembly exactly as submitted. The commission also made a complete revision of all the Illinois statutes relating to coal mining, which code of mining law was enacted by the General Assembly of 1911 without substantial change in the draft of the commission.

Next week we expect to publish a who's who of W. J. Richards, vice president and general manager of the Philadelphia and Reading Coal and Iron Company.

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This journal is interested solely in matters relating to the fuel industries, and is designed to be a medium for the free interchange of ideas, the detailed description of coal-mining practice, and the expression of independent thought calculated to benefit both operator and miner.

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COAL AGE

The Children's Bureau

Of all present-day inquiries the most important is that which is concerned with the character of the coming generation. Starvation, disease and the hangman's rope no longer weed out the unfit with the ruthless frequency of the past.

Under modern institutions almost all are saved to bless or ban society and all must be fit and moral or the prophecies of human degeneracy will prove too sadly true. There are already signs that preservative civilization is not without its drawbacks and that only scientific methods can meet the unfortunate conditions which science and human agglomeration have caused.

Pedagogy and paidology have been the hobbies of the faddists for two score of years. We have framed all legislation relating to children and youths not on proven physical law, but on our prejudices and fears. This condition should now end and in future all conclusions should be based on careful physiometrical observations. Length of limb, strength of arm, chest capacity, reaction time, power of endurance are almost as exactly measurable as volts, amperes or foot-pounds.

It is important, therefore, that the United States Children's Bureau should shut its eyes resolutely to the guesses of the Germans, the assumptions of the English and the purblindness of our many states and should build like our forefathers from the ground up.

Some time ago to test the effect of benzoate of soda, a "poison" squad was formed. Let the Children's Bureau also have such a squad. Let it take, with the parent's and the child's consent, 20 boys of normal development and 13 years of age. Let these boys do light work in the mines, preferably with their fathers, every other day and spend the other days at school.

Let 20 other boys serve as controls, spending their lives in the school and playground. Every six months, let the educational and physiological progress of the children be determined and after they reach the age at which all leave school let the careers of the young men be compared.

These details might be modified and the investigations should not be confined to the coal industry. The object of this editorial is not to formulate a specific program but rather to suggest that we delay our decision as to what legislation we shall advocate till we have some data on which we can rely.

The way in which the governmental world has been stampeded by the clamor of agitators and cranks is not creditable to this twentieth century. Legislative bodies are remaking conditions without any scientific inquiry. A little is known, it is true, about adult physiology but the growth of the physiologic organs has barely been considered.

We are much afraid that unless an effort is made to arouse it to a higher level the bureau will rest content to publish the neuroticisms of Europe, to quote foreign laws and to compile bibliographies of the work of faddists.

We know that the laws of the United States, Germany, England and France are not based on careful investigation, for indeed the prevailing commission method of inquiry which all have pursued has never developed any conclusions of real value.

Fortunately, no Congressional or Royal Commissions have met to discuss the sea serpent. Had they so met, we should have evolved an animal more terrible than Olaus Magnus ever imaged and we should have forbidden the merchant marine to leave sight of land.

The newly chosen head of the Children's Bureau is Miss Julia C. Lathrop. She has a long record of good administrative work at Hull House, Chicago, Ill., and she appears to have the emotional side of her sympathetic nature under complete control.

But it must be remembered that her future labors will not be administrative but investigatory and that rural conditions present problems not easily solvable by those who have worked largely in cities as

has Miss Lathrop. It is true that she has visited prisons throughout Illinois but her main work has been in an urban center.

We wish that instead of a graduate of Vassar College, some careful student with a physiologist like Hugo Munsterberg had been chosen for the position, but the forces which created the bureau, A. J. McKelway in particular, had one end in view, namely to advance the age at which children should be allowed to work. We fear, therefore, that Miss Lathrop and her well meaning friends are about to show us not what they can find out but how much legislation they can put in the statute books.

We do not desire to see one single child sacrificed to any false faith, but if they must be offered up, it is preferable that it be on the altar of industry rather than on the altar of idleness.

The Experimental Mine

Our position with regard to the Bruceton mine has been so frequently stated either at length or by implication that we hesitate to make it the basis of any further comment. We are impelled to weary our readers only because, to our great surprise, we find that perfect unanimity does not exist as to the attitude with which this part of the work of the bureau should be regarded.

We are astonished to learn that the portals to the experimental mine should be boarded up and that those "spectacular explosions," which have modified mining practice almost from ocean to ocean, have not been of value because they have not been new. Nevertheless, despite all adverse criticisms, we believe with W. E. Garforth that spectacular explosions have a value at least equal to those which are conducted for the purpose of determining principles.

It must, of course, be conceded that some companies under enlightened management protected their mines against dust before the Bureau gave its demonstrations and we readily grant that others would have done so sooner or later, but it is nevertheless a fact that the Bureau has in a short while made such protection more general than it would otherwise have been. And in this work the experimental mine has been the efficient means by which that development has been made possible.

The articles by John Verner, which it has much pleased us to print, may or may not agree with the conclusions arrived at by Mr. Rice and other Bureau engineers. We do believe, however, that a large measure of truth may be found in them, and that it is somewhat mysterious if a body of flame can journey continuously with an unchanged air supply without extinguishment.

Mr. Verner's remarks and the frequent discussion of readers show that interest in explosions has not died and that the Bruceton inquiries are being followed with unflagging attention and no little profit. The public is fully aware that much needed information has still to be drawn by experiment from the secretive silence of nature.

So it is safe to assume that the conditions which favor an explosion are to be regarded as of more than mere academic value. It is the height of absurdity to allege that mining men only desire to know that coal dust will explode and that they are utterly indifferent as to when and where that explosion may be expected to occur.

We only regret that the shortness of funds in the past has made more extended use of the galleries impossible and hope that the Garforth, Taffanel and Lemaire systems of protection may in the future be thoroughly tried and their most effective disposition elucidated.

It is to be hoped that the relative safety of the open method of working known as long-wall may be compared with the room-and-pillar method, so that we may know whether open spaces favor dust explosions. The value of weak and strong stoppings at the initiation of such disasters should also be tested and, for lack of trial, we should not be left to guess whether tornado ventilation is or is not undesirable and whether shots should be fired in still or moving air.

We have long wanted to know what whitedamp really is and only in an experimental mine can we learn its true nature. Moreover, in the more distant future we may glean some data of value relative to sand filling and roof action from investigations of the Bureau in the Bruceton workings.

In short, we are most sanguine in our hopes that a great future is before the experimental mine. It is the most practical feature in the Bureau's work. We feel that, of all forms of experiments, the investigation of explosives cannot be safely trusted to individual initiative as such inquiries involve much expense.

The fact that there are perhaps 25 per cent. of the coal mines, which cannot be helped by this part of the activity of the Bureau, as at present conducted, is not a worthy objection to the work under way. In the other 75 per cent. of the coal-mining industry, no investigations are more frequently discussed or so rarely receive unfavorable comment.

We conclude, feeling sure that our praise will be regarded by most men as unnecessary, for we fear they will be unable to understand how any thinking man can possibly condemn a work, which, while it has produced no new discoveries, has done more than any other activity to save the lives of the workers in the mines.

The Plugger Drill

While the plugger drill is well known and much used in metal mines, and has had extensive applications on the surface, it has had little attention in the coal industry of the United States. The common opinion is that the use of a tripod is necessary if any compressed-air drilling is required. The labor of moving this before and after each shot, and the unsuitability of the larger machines to work in narrow ditches, have made the use of power drilling infrequent.

It is certain that the larger machines are required where rock tunnels have to be drilled, but where all that is needed is ditching or trimming, the light hammer is well suited. It is extremely portable, rapid in action and accommodates itself to restricted quarters. The average machine weighs only about 60 lb., and abroad, notably Germany, far lighter machines have been made. As for the efficiency and value of such a midget hammer, we cannot vouch, but those weighing about half a hundredweight are giving entire satisfaction.

As we have before stated, in Europe rock drills of various kinds are used in coal mines, and it seems strange that they find so little use and favor here. In view of the fact that they have been so little tried, it would seem that their nonadoption has not been due to their defects, but to our lack of knowledge of their value.

Discussion by Readers

Comment, Criticism and Debate upon Previous Articles, and Letters from Practical Men

Should Mine Fans Be Built Reversible

Letter No. 15—In response to your inquiry as to the advantages of reversible mine fans, I desire to say that I believe a nonreversible fan is much better, as far as the safety of the men in the mine is concerned. As a general proposition, unless influenced by climatic conditions, I am in favor of an exhaust fan where mines generate any gas, and if the mine workings are properly laid out I can see no reason for the installation of a reversible fan. On the other hand, the investigation of a number of accidents that have occurred in the past three or four years convince me that the reversing of fans has caused much loss of life.

You have already published a number of letters in COAL AGE which generally favor the adoption of reversible mine fans, but I note in each of these letters there are certain exemptions and provisions made, stating that "if such were the case the reversible fan would be better." My idea is to eliminate that "if" and all doubts that generally follow.

I frankly confess that I have installed a number of reversible fans, having been persuaded by the salesman that it was the only safe thing to do, but an investigation made about a year ago readily convinced me that not once had one of our fans been reversed. In checking this matter up thoroughly and discussing it with our superintendents and mine managers, who have been in the service of our various companies for periods up to 25 years, I find that never have any of our fans been reversed in case of explosion or fire. This applies particularly to Oklahoma where the mines are very gassy and fires and explosions are matters of frequent occurrence.

There is a wide difference between the control of men in an open workroom or in a field where the leader can be seen by each of the men, and where the effect of every movement can be observed; and the coal miner, who is isolated and perhaps in total darkness at the time of an accident. Men naturally are creatures of habit; and, after a miner has followed an air-course daily for a certain number of years and knows where to look for a supply of air, it is not reasonable to assume that, in the confusion and excitement following an accident, he would or could, in his isolated location, reason out what *may* happen on the surface. Undoubtedly many mines have employed men for years who do not know that the fans can be reversed; and there are many foreigners who understand little about the principles of ventilation, and to whom the reversing of the air current cannot be properly explained. Theoretically, the reversible fan is a good safeguard; practically, I regard it as a menace to safety and feel that the nonreversible fan is preferable.

CARL SCHOLZ.

Vice-President and General Manager Consolidated Indiana Coal Co.

Chicago, Ill.

Letter No. 16—The reversing of the circulation in a mine is undoubtedly a serious matter and should never be done by any one without consultation. I believe, however, that circumstances may arise in which such a decided advantage is to be gained by reversing the air current, that all mine fans should be so constructed that the air in the mine can be reversed.

The explosion in the Primero mine, Jan. 21, 1912, closed up the main intake of the First North Mine, but did not seriously damage the fan. By going into the First East Mine, at Primero, and knocking down a stone wall, which had not been destroyed by the explosion, we were able to make connection between the First North and the First East Mines, at a point several thousand feet from the fan.

If it had been necessary to continue the operation of the fan as an exhaust we could not have reached the workings of the First North Mine, except by a very circuitous route through the First East Mine, involving a tramp of at least one and one-half miles; but by changing the exhaust to a blowing fan we were able to restore the circulation at once between the fan and the point where we blew down the stopping.

We were thus enabled to reach a point on the main air-course at least 3000 ft. from the fan, in less than two hours. By starting the work of repairing entry stoppings, at this point, we were able to reach and save the life of at least one man, who would have been lost, had it been necessary to go through the First East Mine air-course to reach him. Beyond the point where we broke through into the first north we were able to use the first north return air-course to recover the mine, and reach the bodies, which work would otherwise have been delayed several days.

The fire that occurred at our Fremont mine, Nov. 1910, furnishes another instance of the need of a reversible fan. The fire started in the stable between the main intake and return air-courses. The fan worked normally as a blowing fan and the haulage road was the return airway. After all the men had been withdrawn, we reversed the fan and were then able to go down the main haulage road, which was changed to an intake by the reversing of the fan. We reached the water pipes in the vicinity of the stable, and immediately began fighting the fire from this side.

These are two instances, taken at random, where the ability to reverse a fan was of great advantage.

E. H. WEITZEL.

Manager, The Colorado Fuel & Iron Co.

Pueblo, Colo.

Letter No. 17—I have been much interested in the recent discussion, relative to building mine fans reversible. While I approve of much of what has been said, there are some statements with which I disagree.

My opinion is that a mine fan should be built reversible only when it is absolutely necessary; and this should be determined by a joint conference of the mine inspector of the district and the officials of the mine. If the mine inspector can show a clear case *why* the fan should be reversible, I think the mine officials should submit to his opinion; but otherwise they should not be forced to incur the extra expense of building a reversible fan.

I do not favor the idea of a compulsory mine law that would require all companies to install reversible fans, especially if they already have a nonreversible fan in operation, at the mine.

A long experience in mining has taught me that air currents can be reversed as quickly and as effectually, by arranging doors and regulators, and, perhaps, building an overcast, to conduct the main current into another airway, which would then become the main intake. Such an arrangement is easily installed; but, of course, is open to the objection that it is located underground and may not be available under conditions that may exist in the mine.

Referring to mine fires and explosions, I want to suggest that every mine should be so planned as to make it possible to meet any emergency that may arise.

Emergency doors and regulators should be built, at certain places in the mine, that will enable the men in charge to change the air current, or to reverse the same, in any section. When the men are not in the mine, the air current should be reversed occasionally, in order to test the system and make any corrections or improvements that may be necessary.

In case an explosion should occur in a shaft or slope mine, and all the doors, stoppings and regulators in the mine were destroyed, I think all will agree that a reversible fan, in this case, would have no advantage over a nonreversible fan. The first step, in this case, would be to enter the mine by the intake airway and restore, in order, the stoppings, doors, etc., so as to reëstablish the circulation.

I do not, however, wish to condemn the building of reversible fans. I believe, under certain conditions, such fans would prove a benefit.

Some 20 years ago, I was working in a slope mine, in Alabama. The slope dipped at 25 or 30 deg., for 1000 ft., where it reached the basin or level. Here the road ran level a distance of 300 ft. and then started on an upgrade of 10 or 15 deg. Headings were driven on the strike of the seam to the right and left of the main haulage road and 300 ft. apart, with an air-course on the lower side of each heading. No headings were driven on the first thousand feet, which was the slope road. The mine was ventilated by two exhaust fans, located, respectively, at the mouth of the two main-return airways, on each side of the main slope, which was the main intake for the mine. There was a door at the mouth of each cross-heading to deflect the air current to the face of the heading.

A fire had started at the face of the first-right heading, which had been driven about 2000 ft. from the main entry. The fire was caused by the miners' shots, fired the night before payday, and received little attention until it had gained much headway.

After a brief consultation, the mine foreman agreed to my plan to short-circuit the smoke by breaking down a stopping, between the heading and the air-course, at a point as close as possible to the fire. Then, by a simple arrangement of the doors and a temporary brattice on the main entries, the intake current was short-circuited and thrown into the cross-heading. By this means the smoke was driven back and carried out on the main-return air-course.

The point I wish to make is that if the fan had been reversed, in this case, the main-haulage road and intake would have been made the return and filled with smoke so as to be impassable. By short-circuiting both the smoke and the air current as described, however, it was possible for the men to get near the fire, which was soon under control.

It should always be considered a serious matter to reverse the fan, as it may prove that what was a good return airway will make a poor intake, on account of leakage when the air is reversed. It may happen that the reversing of the air will fill the mine with blackdamp, driven out of the old workings by the change of the current. Or a dangerous accumulation of firedamp, in some abandoned room, may be driven out onto the airway and ignited by the fire or the lamps of the men. All these conditions should be carefully considered before deciding to reverse the air in the mine.

G. T. M.,
Republic, Ala. Fireboss.

Reducing Ventilation at Firing Time

I notice in looking over some back issues of COAL AGE, an extended discussion on the requirements in ventilation at firing time. I have been much interested in the theories advanced by some of the writers. I discover that, according to the results figured out on paper if the ventilation is reduced at firing time, a very dangerous condition will exist, in a mine generating firedamp. I fail to see recorded, however, any practical tests that the writers have made, in support of their theories regarding the reducing of the ventilation at firing time.

Believing that I am the first person to adopt this method of preventing an explosion of coal dust in the mine, and having made many tests on increasing and reducing the ventilation during firing time, I am deeply interested. My experiments were not made in an artificial testing station, but in many of the most dangerous mines in this country. In the investigation of this subject, I have made close examinations of seventeen explosions. I am thankful to say that I am a survivor of three and have led in the rescue work in nine explosions. I have been later put in charge of many of these mines and never had an explosion in one of them since.

Before we can prescribe a remedy to prevent mine explosions, we must know the factors that constitute the explosion. In the coal mine, we have three classes of explosions, namely: The coal-dust explosion, the firedamp explosion and the carbon-monoxide or mine-fire explosion. The mining men of the world now agree that coal dust is a dangerous explosive when thrown into the air and exposed to a flame of high temperature. We have, therefore, three factors contributing to a coal-dust explosion, namely; coal dust, air and flame.

At some time, later, I will give the results of these tests made in the most dangerous mines in this country, and will show that it became necessary to seal up the mine, in some cases, in order to prevent an explosion of coal dust. In three instances I predicted explosions and pointed out the place in the mine where the explosion would start, and was correct in every case. I hold the sworn statements made by those present on each occasion. My experience in coal mines, in recent years, has proved to me that the earlier teachings I received on the prevention of coal-dust explosions was wrong.

ALEXANDER MCALLISTER.
Croweburg, Kan.

Testing for Gas

The detection and estimate of the quantity of gas present in a mine does not depend so much upon the lamp or the oil used as upon the observer. A person with good eyesight should be able to see a 2-per cent. cap. When a 2½-per cent. cap is not detected, something is wrong with the eyesight or powers of observation. Miners should train themselves to detect caps readily and to estimate the amount of gas present. To do this they should test their working places at least once a day for gas. After they have ascertained that gas is present, let them lower the light to the smallest possible size without putting it out. When the eyes are accustomed to the darkness look for the cap. Unless the percentage is 4 per cent. or over the cap will be small. Gradually increase the size of the testing flame and watch the cap carefully. With the increase of flame the cap will increase in size, its visibility will also change. With a percentage below 3 the cap soon disappears in the bright light of the testing flame. A percentage of over 3 remains visible with quite a large testing flame. An excess of 4 per cent. gives a plainly visible cap reaching to the top of the glass. With 5 per cent. the lamp fills with flame.

FIREBOSS.
Scranton, Penn.

Illuminating Cross Hairs

Referring to the note on "Illuminating Cross Hairs," COAL AGE, Nov. 2, p. 612, permit me to draw attention to the following references to this subject:

Otto Brathuhn in his "Lehrbuch der praktischen Markscheidekunst," etc. (4th edition, press of Veit & Co., Leipzig, 1908), p. 106, recommends a piece of tracing paper, to be used for the purpose mentioned.

Ed. Borchers in his "Die praktische Markscheidekunst," etc. (published by Carl Rümpler, 1870), p. 105, recommends a piece of oiled paper, for the same purpose.

The discovery of J. Smith, of Hibbing, Mich., is not new, therefore. The principle consists in using some transparent area, a piece of glass, porcelain, etc.

V. SRAJN,
Hymera, Ind.

Inquiries of General Interest

All Questions Must be Accompanied by Name and Address—Not for Publication

Secondary Splitting

Will you kindly calculate the natural division of an air current of 200,000 cu.ft. per min., in the following described mine: The shafts are each 12x18 ft. in cross-section and 1200 ft. deep. At the bottom of the shaft the air current is divided into two splits as follows:

Split A, 6x10 ft., 3000 ft. long.
Split B, 6x12 ft., 1800 ft. long.

At a point 900 ft. from the foot of the shaft, split *B* is again divided into two splits, as follows:

Split C, 6x8 ft., 2000 ft. long;
Split D, 5x12 ft., 1600 ft. long.

The lengths given for each split include the return air-courses. No regulators are used in any of the splits. Please give the quantity of air that will pass in each split and the total pressure and horsepower required to produce the circulation.

GLENN J. R. TOOCHMON,
Mining Engineer.

Welch, W. Va.

In order to make clear the relation of the several air splits in this problem we have prepared the accompanying sketch, which shows a vertical section through the two shafts 1200 ft. deep. At the bottom of the shafts is shown a horizontal plane on which the four splits *A*, *B*, *C* and *D* are drawn.

The lengths given for each of these splits are the total lengths of the intake and return air-courses. It will be observed that the total volume of air (200,000 cu.ft. per min.) must pass through each shaft, downcast and upcast. At the bottom of the downcast shaft the intake current divides between splits *A* and *B*, which is the *primary split;* and 900 ft. inby from this point, split *B* divides between *C* and *D*, which is the *secondary split.*

Calling the shaft *S*, and designating the several splits by *A*, *B*, *C*, *D*, respectively, the area, perimeter and length of each section are as follows:

S, $a = 216$ sq.ft.; $o = 60$ ft.; $l = 2400$ ft.
A, $a = 60$ sq.ft.; $o = 32$ ft.; $l = 3000$ ft.
B, $a = 72$ sq.ft.; $o = 36$ ft.; $l = 1800$ ft.
C, $a = 48$ sq.ft.; $o = 28$ ft.; $l = 2000$ ft.
D, $a = 60$ sq.ft.; $o = 34$ ft.; $l = 1600$ ft.

Now find the potential for each section, separately, by substituting the given values in the formula:

$$X = a\sqrt{\frac{a}{lo}}$$

Following are the potential values for each section:

S, $X_s = 216\sqrt{\frac{215}{2400 \times 60}} = 8.366$

A, $X_a = 60\sqrt{\frac{60}{3000 \times 32}} = 1.500$

B, $X_b = 72\sqrt{\frac{72}{1800 \times 36}} = 2.400$

C, $X_c = 48\sqrt{\frac{48}{2000 \times 28}} = 1.405$

D, $X_d = 60\sqrt{\frac{60}{1600 \times 34}} = 1.993$

The next step is to find how the main current divides between splits *A* and *B*. This is the first or primary split, at the shaft bottom. The division of the air is

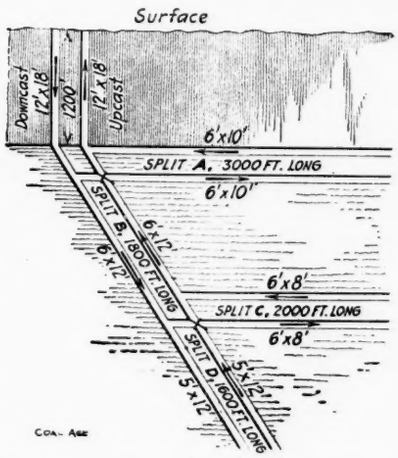

DIAGRAM OF MINE—VERTICAL AND HORIZONTAL SECTIONS

found by substituting the potential values found in the following formula, which gives the quantity of air passing in split *A*:

$$q_a = \frac{Q}{1 + \frac{X_b (X_c + X_d)}{X_a \sqrt{X^2_b + (X_c + X_d)^2}}}$$

In order to simplify the substitution in this formula, first, find the values

$$X_c + X_d = 1.405 + 1.993 = 3.398$$

$$\sqrt{X^2_b + (X_c + X_d)^2} = \sqrt{2.4^2 + 3.398^2} = 4.16$$

Substituting these values in the above formula,

$$q_a = \frac{200{,}000}{1 + \frac{2.4 \times 3.398}{1.5 \times 4.16}} = 86{,}700 \text{ cu.ft. per min.}$$

The quantity of air passing in split *B* is then

B, 200,000 — 86,700 = 113,300 cu.ft. per min.

The next step is to find how the current passing in split *B* divides between splits *C* and *D*, in the usual manner; thus

C, $q_c = \frac{1.405}{1.405 + 1.993} \times 113{,}300 = 46{,}850$ cu.ft. per min.

D, $q_d = 113{,}300 - 46{,}850 = 66{,}450$ cu.ft. per min.

Having found the quantity of air passing in each split or section of the mine, the pressure for each section can be found by substituting the several values in the formula for unit pressure

$$p = \frac{k s q^2}{a^3}$$

in the usual manner. The sum of the pressures thus found, for all the sections, is the total ventilating pressure for the mine. Or the total pressure can be found, at once, by substituting the potential values, as found above, in the following formula:

$$p = \left[\left(\frac{Q}{X_c}\right)^2 + \left(\frac{Q\sqrt{X^2_b + (X_c + X_d)^2}}{X_b (X_c + X_d) + X_a \sqrt{X^2_b + (X_c + X_d)^2}}\right)^2\right] k$$

Substituting values in this formula and expressing the quantity Q in thousands of cubic feet and making $k = 0.02$, we find the total pressure

$$p = \left[\left(\frac{200}{8.366}\right)^2 + \left(\frac{200 \times 4.16}{2.4 \times 3.398 + 1.5 \times 4.16}\right)^2\right] \times 0.02 = 78.24 \text{ lb. per sq.ft.}$$

The horsepower on the air, or the horsepower required to produce this circulation, is then

$$H = \frac{200 \times 78.24}{33} = 474 \text{ hp.}$$

Legal Weight of Coal Per Bushel

What is the legal weight of a bushel of coal?

COAL OPERATOR.

Johnstown, Penn.

The weight of a bushel of coal, as established by law in different states varies. The legal weight of a bushel of bituminous coal is given by a Bulletin of the Bureau of Standards, Washington, D. C., as 80 lb. in Ohio and West Virginia, and 76 lb. in Pennsylvania and Kentucky.

The legal weight of a bushel of "mineral coal" is given as 80 lb., in Colorado, Indiana, Michigan and Missouri, and 76 lb. in Kentucky and Montana.

The legal weight of a bushel of "stone coal" is given as 80 lb. in Illinois, Iowa, Kansas, Mississippi, Nebraska, North and South Dakota, Oklahoma, Tennessee, Texas, Virginia and Georgia, and 76 lb. in Kentucky.

State law makes the legal weight of a bushel of "cannel coal" 76 lb. in Kentucky, and 70 lb. in Ohio.

The terms "mineral coal" and "stone coal," as used above, are simply localisms of the mining law of those states, used to designate the general term, coal.

Examination Questions

Selected from State Examinations, or Suggested by Correspondents

Examination Questions

(Answered by request)

Ques.—A mine, operating a flat-lying coal seam about 1000 ft. below the surface, is dangerous on account of the pressure of gas in the workings. The mine is ventilated by two exhaust fans, each delivering 200,000 cu.ft. of air per minute; one pulling from an upcast shaft 12x14 ft. in section; the other pulling from an upcast bratticed compartment of the hoisting shaft, also 12x14 ft. in section. The main hoisting shaft is 1000 ft. deep and has, in addition to the air compartment, four hoisting compartments, each 7x12 ft., in the clear, which form the intake for the mine.

The two fans are pulling on the two main splits from the same intake, but the arrangements are such that each fan may pull from either split, by making a change of doors. It is desired to get more air into the workings, with a smaller water gage, the present gage being 2 in. It is also desired to retain the duplicate features for use, in case of one of the fans being disabled by accident. State what changes you would suggest to secure the desired results.

Ans.—Without a plan showing the present arrangement of entries and the circulation of the air currents in the mine, it is only possible to state, in a general way, that the rubbing surface must be decreased, or the total *area of passage* in the mine increased. This can be done in several ways, any one of which might be best adapted to a given case.

The rubbing surface can only be decreased by shortening the air travel wherever this can be done to advantage. As the development of the cross-entries progresses, it is often possible to carry the air current or a portion of it across through rooms that have broken into each other, or through a crosscut in the chain pillar; thereby, shorten the air-travel.

The area of passage, in the mine, can be increased: (1) By splitting the air current wherever this can be done advantageously or without too far reducing the velocity of the current. (2) By cleaning up the air-courses, enlarging the breakthroughs and removing all unnecessary obstructions to the flow of the air current. (3) By enlarging the sectional area of the main airways wherever this is practicable, so as to reduce the velocity of the air passing through them.

In this case, it may be possible to provide two intake openings instead of one, which should then be done, as the single intake is the real obstruction here, because the entire current must pass through this entry with a high velocity.

Ques.—How would you work the chambers, in a seam of coal having a dip of 35 deg., the thickness of the seam being 12 ft? Overlying the seam is a fireclay roof about 3 ft. thick, which falls soon after the top bench of coal is taken down. Above the fireclay is a good, hard sandstone roof. Due consideration must be given to the future drawing of pillars; also, to the greatest economy in mining and the safety of the workmen.

Ans.—For this inclination of seam the gangway may be driven in the lower

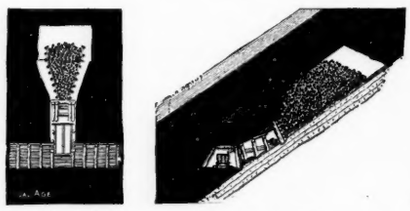

FIG. 1. WORKING A THICK INCLINED SEAM OF COAL

bench of coal, practically level or following the strike of the seam, with sufficient allowance for drainage. As shown in Fig. 1, chutes are turned narrow off the gangway, on the full pitch of the seam for a distance of about 6 or 8 yd. At this point a battery of heavy cross-timbers is put in after the chute has been widened out to form a chamber.

A manway is bratticed off on one or both sides of the chute and carried up the sides of the chamber to provide a way of ingress and egress to the face of the chamber. This manway is constructed by setting a line of posts about two feet from the rib and nailing boards to the posts, on the chute side, as shown in Fig. 1.

The chamber is driven up, in the lower bench of coal, in the manner described. The top coal is left up to support the fireclay overlying the coal and furnishes a good roof in the first working. The coal mined is allowed to fill the chute in the center of the chamber, and the miner stands on the loose coal while working at the face.

Since the broken coal fills from two-thirds to three-fourths more space than it occupied in the solid, and the cross-section of the chute is less than that of the chamber, the coal must be drawn from the chute, from time to time, as the face advances, so as to give the miner room to work.

When the chamber has been driven up to the line of the chain pillar, which is left to support the gangway above, the work of drawing back the pillars separating the chambers, and taking down the top coal is begun. Crosscuts are first driven through the pillars, at the face; and from this crosscut the pillar is worked back in steps, or by taking "skips" off the rib.

The pillar work should be kept somewhat ahead of the work of "falling" the top coal. Some difficulty may be experienced, at this stage of the work, in keeping the coal clean and preventing the fireclay from falling into the chute with the coal. Timbers should be laid on the floor above the coal, and the refuse thrown back in the waste above the timbers.

Ques.—In the ventilation of a pair of entries driven on the strike of a pitching seam, where should the stoppings be built in the crosscuts in the entry pillar?

Ans.—The stoppings in the entry crosscuts should be so placed as to avoid, as far as possible, forming empty places or pockets where gas will accumulate in dangerous quantity.

Referring to Fig. 2, suppose *A* marks the face of the intake heading on the dip side of the haulage road *DB*, which is the

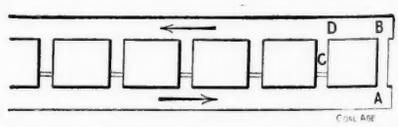

FIG. 2. SHOWING POSITION OF STOPPINGS

return airway, the mine being free from marsh gas (CH_4), but generating the usual quantity of blackdamp that comes from abandoned rooms and other waste places. It is wrong to build the stoppings (*C*) in the lower end of the crosscuts, close to the air-course, because this would leave large pockets above the stoppings that would fill with blackdamp and be difficult to ventilate. The stoppings, in this case, should be built in the rise end of the crosscuts.

On the other hand, if the mine is generating marsh gas, the circulation should be reversed, making the haulage road *DB* the intake and *A* the return airway. The stoppings should then be built in the dip end of the crosscuts, as shown in the figure, to avoid the accumulation of gas at these points.

Sociological Department

For the Betterment of Living Conditions in Mining Communities

Soot and Coal Dust Not Similar in Pathogenic Action

Sir Thomas Oliver, in a speech before the Fifteenth International Congress of Hygiene and Demography, made the following remarks on the effects of soot. They are in themselves interesting because many of those coke towns where byproduct ovens do not exist are smoky in the extreme, and the pathogenic conditions in large industrial centers must be duplicated with even more baleful results in such towns. Some of our smaller less well ventilated mines are full of smoke, from another source and of a different character, but the smoke is probably equally irritating.

Is Mine Air or Coal Dust Germicidal?

However, the principal point of interest is that soot acts in a different manner from coal dust. It increases the action of incipient tuberculosis, whereas coal dust has an unfavorable effect on tubercule germs. Soot has only a mild action in preventing infection by tuberculosis, whereas coal dust is active in its immunizing qualities.

But the interesting feature of the remarks of Sir Thomas Oliver seems to be the view that is taken that the acid elements in the soot, whether a part thereof or absorbed after formation, are not only irritant, but an aid to tubercular development. If that is so, it is clear that the mine atmosphere, which Wainwright and Nichols* have shown to be sterile, is not really destructive of germ life, but merely becomes sterile by the mechanical action of germ deposition, which results from the continual condensation and dew fall of the moisture contained in it. This is the conclusion to which the aforementioned doctors arrived.

If this is so, a mine which is kept moist by sprays or the injection of steam into the intake is thereby made more suitable rather than less fit for human occupation, provided, of course, that the temperature is not excessive. Karl F. Schoew, in an article before the West Virginia Coal Mining Institute (see Coal Age, Vol. 1, p. 1178), refers to this cleansing effect by condensing water:

To quote Sir Thomas Oliver: "In the rise of modern industries, two things at least strike us: (1) The effect of occupations upon those employed in them, and, (2) the influence of industrial operations on the air of neighboring localities and upon the persons dwelling therein. The multiplication of industries cannot but have in some instances an unfavorable influence upon people born and reared in the shadow of factory chimneys.

*Coal Age, Vol. 2, p. 303.

Tuberculosis Severe in Industrial Centers

"Comparing the death rates of agricultural and industrial districts, country data stand out favorably as against those of towns. The extent to which mortality rates vary in industrial centers has been studied by Dr. Louis Ascher, of Konigsburg*, whose contention, speaking for his own country, is that as Germany has become more industrial, her death rate, especially from acute pulmonary disease, has risen, and for this the increasing volumes of smoke thrown into the atmosphere are largely responsible.

"The mortality curves for tuberculous and nontuberculous diseases are highest in large towns. They bear a distinct relationship to the size of the town, the density of the population and the social well-being of the people.

Soot and Tuberculous Disease Antagonistic

"In the industrial districts of Germany, the mortality from nontuberculous diseases has increased, especially in children and old people. In 1882, Finkelburg showed the existence of a high tuberculous mortality rate in textile districts, and a high nontuberculous rate in smoky industrial centers.

"He found that the death rate from acute inflammatory diseases of bronchi and from catarrhal affections of the lungs was highest where much coal was burned, in contrast with the mortality from pulmonary tuberculosis, which was highest in textile towns.

"Between 1875 and 1879, the mortality in Prussia from acute lung diseases was 18 per 1000; in 1900 to 1904, it was 27 per 1000, or an increase of 70 per cent. in 25 years, while during the same period the death rate from tuberculosis fell from 31 to 19 per 1000, a reduction of 36 per cent. The higher mortality from nontuberculous diseases was observed chiefly among elderly people and young children, and occurred mostly in the smoky industrial centers of Rhineland and Silesia.

*Der Einfluss des Rauches auf die Atmungsorgane, Stuttgart, Verlag von Ferdinand Enke. 1905.

Tuberculosis May Be Hastened by Soot

"It is common experience that the course of pulmonary tuberculosis is hastened by living in a smoky atmosphere, also that smoke predisposes to acute lung disease. Soot differs from coal dust in being a spongy material capable of absorbing sulphuric and hydrochloric acid up to 10 per cent., besides retaining other free acid gases and certain oxidation products of a tar-like nature.

"From a respiratory point of view, damp soot is worse than dry soot, hence the harmful effect of fogs. Apart from the loss of sunshine, which the presence of soot in the air of a large city entails, the retained acids, especially sulphuric, are harmful alike to buildings, vegetation and men.

"Professor Rubner, who has given considerable attention to the study of fogs and the harmful effects of smoky atmospheres upon plant life, whereby certain trees are disappearing from large towns, is of the opinion that the human lung cannot be exposed to smoke without undergoing some structural alteration.

The Baleful Action of Smoke

"Like Ascher, he maintains that in Germany a smoky atmosphere is responsible for the increased mortality from lung disease other than tuberculosis. According to Lehmann while the sulphur dioxide contained in soot is absorbed by the nasal mucous membrane, the particles of carbon are carried further into the respiratory passages.

"Finally reaching the lungs, the particles of soot are deposited there, having meanwhile in their descent given up to the bronchial mucous membrane and the lining membrane of the lungs some of the acids they retained.

"The increase of nontuberculous lung diseases is not confined to Prussia alone. It may be taking place, for all we know, in other countries where manufactures are increasing rapidly. The mortality from nontuberculous diseases in the towns is almost double what it is in the country.

Smoke Increases Nontuberculous Lung Diseases

"In towns where much coal is burned, there is a higher percentage of nontuberculous to tuberculous disease—the proportions being in industrial smoky towns

130 to 100 per 100,000 inhabitants, in textile towns 47 to 40 and in country districts 14 to 11. In Lille, which is a mixed manufacturing town, the incidence of tuberculosis is considerable; but Lille has nothing like the high tuberculosis mortality rate which exists in Roubaix, a purely textile town only a few miles away.

"Ascher supplies a further illustration: The small smoky town of Waldenburg is 10 miles from the textile town of Wusterwaltersdorf. In comparing the two towns per 1000 living in 1911, 1901, and 1904, he found the mortality rates to be: In the textile town, 1.83 tuberculosis, 2.23 nontuberculosis. In the smoky town, 1.77 tuberculosis, 2.93 nontuberculosis.

"That is an increase of 30 per cent. of nontuberculous mortality in the smoky district, only 10 miles away. It would seem, therefore, that where smoke is produced in greater abundance, there is also found a higher mortality from acute lung disease. Smoke encourages fog, and fog is destructive to life.

"In Glasgow during a November fog the death rate from acute respiratory diseases including pneumonia was 13.9, but in the other towns of Scotland it was only 3.3. Many uncomplicated cases of pulmonary tuberculosis are within the range of cure. It is infection by other organisms which frequently transforms a possibly curable into an incurable case.

Rabbits Show that Soot Affects Life Unfavorably

"A smoke-polluted atmosphere predisposes to acute lung diseases and hastens the course of tuberculosis. Experiments carried out by Ascher, von Baumgarten and Hildebrandt throw light upon this subject. Ten rabbits received a hypodermic injection of *perlsucht* and were placed in a smoky atmosphere; nine rabbits similarly inoculated were placed in a nonsmoky hutch; other nine animals which had not been inoculated were placed in a smoky hutch as a control experiment.

"All the animals, similarly cared for, were placed in their hutches on Nov. 11. By Feb. 26, all the *perlsucht* animals which had breathed the smoky atmosphere were dead. In the hutch with no smoke, four of the inoculated animals were still alive and lived for 24 days longer. In another set of experiments the animals exposed to smoke lived 53.9 days, and those not exposed to smoke lived 90.3 days.

"According to Ascher in the smoky districts of Germany, there is taking place not only an increased number of cases of acute inflammation of the lungs, but persons who are the subjects of pulmonary tuberculosis die in these smoke-ladened districts more rapidly than those persons similarly affected, but living elsewhere.

Smoke Has Increased Mortality in Great Britain

"I cannot say that in the smoky towns of Great Britain there has been such an increase in the mortality rates from respiratory diseases as has taken place in Germany. Only in four smoky towns out of 19 have I found a rise in the mortality from this cause during the last ten years, also a rise in one textile town out of seven.

"The death rate from pneumonia has risen in six smoky towns, but only in one textile town, while the mortality from pulmonary tuberculosis has risen in two of the smoky and in one of the textile towns.

"With a view of preventing fog and of clearing the atmosphere polluted by smoke from burning coal, greater use of gas fires has been recommended. In trying to obviate one source of discomfort and risk to health, care must be taken that other dangers are not incurred.

"Judging from the odor appreciable on entering a house, wherein gas-fires are burning, more or less unconsumed gas must always escape. Upon women and children working and living in such a house, and inhaling all day long during the winter months small quantities of carbon monoxide, are we quite sure that the ultimate effects produced thereby would not be just as bad as, if not worse than, those caused by fog or a smoky atmosphere?"

Vocational Schools

Some progress has already been made by the Department of Public Instruction at Harrisburg, in coöperation with the directors of the schools in Pennsylvania toward making use of the new school code, which permits school boards to open vocational schools. Some definite movement in its application to mines has been made at Nanticoke, Newport Township, Shamokin, Mt. Carmel and Lansford in the Anthracite region.

E. E. Bach, the enterprising sociological superintendent at Ellsworth in the bituminous coal fields sends us his course of study, and says he is using it in the night schools for boys and men. The Ellsworth Collieries Co., has always been in the vanguard of sociologic endeavor.

Millard B. King, expert assistant in industrial education of the Department of Public Instruction in a letter to us, states that "conditions are such in the anthracite region at the present time that whatever work is attempted must be of such a character that the high-school science teacher can handle it. It is the best we can do at the present time as the boards are either not in a financial position or are unwilling to employ a man for this work alone."

We publish his outline of work for night continuation schools in full. It will serve for reference when the organizations of night schools in other states is under discussion. It will be seen that it is purposed also to give carpenters, firemen and steam engineers, the benefit of instruction suited to their needs.

Curriculum for Night Schools

First Year.

Required of all students

English	40 lessons
Mathematics I	40 lessons

Mining students

Mining law	40 lessons
Mine gases	20 lessons
Mine surveying	20 lessons
Mine ventilation	20 lessons

Carpenters

Architectural drawing	40 lessons
Accounts and estimates	40 lessons

Firemen and steam engineers

Mechanical drawing	30 lessons
Mechanics I	40 lessons
Reports and accounts	10 lessons

Second Year

Required of all students

English	40 lessons
Mathematics II	40 lessons

Mining students

Mining law	10 lessons
Mine surveying	10 lessons
Mine ventilation	20 lessons
Electricity I	20 lessons
Timbering, haulage, pumping	20 lessons

Carpenters

Architectural drawing	40 lessons
Contracts and specifications	20 lessons
Mechanics II	20 lessons

Firemen and steam engineers

Mechanical drawing	20 lessons
Mechanics I	20 lessons
Electricity I, II	40 lessons

MECHANICS I.

General consideration of the composition and properties of air and their effect upon combustion.

BOILERS

Types of boilers. The construction and materials used in the construction of boilers. Combustion of fuel. The furnace: types of grates, combustion chamber, ashpit, flue connections. Size and construction of the chimney. Stokers. Drafts. Pounds of water evaporated per pound of fuel burned. Pounds of water evaporated per hp. per hour. Ratio of grate surface to heating surface. Pounds of air required per pound of coal burned. Smoke prevention. Methods of firing a boiler; spreading, side firing, coking method. Cleaning and banking fires. Boiler fittings. Feedwater heaters. Feed water pumps and injectors. The causes, inconvenience, removal and prevention of boiler scale. Principle of the pressure gage. Boiler explosions. Safety appliances. Boiler testing.

STEAM ENGINES

Kinds and sources of energy. The generation, storage, transformation, transmission, and application of energy. Principle of the steam engine. Units of output. Calculation of the horse-power of an engine. Condensing and noncondensing engines. Simple and multiple expansion engines. Valve gears. Fly-ball, loaded and shaft governors. Winding and hauling engines. Construction of engine foundations and footings to prevent vibration. Alignment of outer pillow-block or shaft bearings. Indicators and indicator diagrams. Dynamometers. Siphon, jet, surface, gravity and pump condensers. Essentials of a good lubricant.

PUMPS

Principle of the siphon, lift pump, force pump, rotary pump, duplex and quadruplex pump. Electrically operated pumps.

AIR COMPRESSORS

General consideration of the expansion and compression of air. Air compressors. Air motors.

MECHANICS II

The three laws of motion. Force. Force of gravity. Center of gravity. Stress. Energy. Work. Conservation of energy. The principles of the lever, wheel and axle, winches, capstan, toothed wheels, pulleys, screw jack, wedge and inclined plane. Solution of problems involving the above principles. Equilibrium, moments, parallelogram of forces. Graphical representation, composition and resolution of forces. Flexure of beams. Loads on beams and the reaction of the supports. Consideration of snow, live, wind and dead loads. Graphical determination of the stresses in a simple member. Calculation of the load per sq.in. of cross section of a uniformly loaded beam. Beams with concentrated loads. Factor of safety. Accepted values of tension, compression and shearing stresses for materials commonly used.

ELECTRICITY I

Principles, care and use of the primary cell. Consideration of the ohm, volt, ampere, watt and resistance. Simple and branched circuits. Multiple and series connections. Principle, care and uses of the storage cell. Magnetic properties of a coil. Principle of the telephone and telegraph. The incandescent light and electric lighting. Principle of the dynamo and motor, and their uses. Transmission of power in the mines and insulation. Precautions to be taken in the mines where electricity is used.

ELECTRICITY II

The uses of the shunt-, series- and compound-wound dynamos and motors. Alternating-current machines. Advantages and disadvantages of alternating current as applied to the mines. Principle of the transformer. Causes of sparking and the remedy. Care and operation of electrical machinery.

TIMBERING, HAULAGE AND PUMPING

Force of gravity. Center of gravity. Parallelogram of forces. Composition and resolution of forces, and their application to timbering. Practical talks on timbering by mine foreman. Haulage systems. The advantages and disadvantages of the various systems. Consideration of the conditions governing the selection of a haulage system. Pressure beneath the surface of a body of water. Atmospheric pressure. Principle of the siphon, arrangement and operation of pumps. Location, uses, and construction of dams.

(To be continued in an early issue.)

Wilkes-Barre District Mining Institute

The second monthly meeting of the Wilkes-Barre District Institute, for the present winter, was held on Saturday evening, Nov. 9. Vocal solos were given by Joseph Morris and Thomas Morgans, and an illustrated lecture on "The Conservation of Coal Miners" was delivered by Supt. H. G. Davis, of the Delaware, Lackawanna & Western.

Mr. Davis prefaced his lecture by declaring himself in favor of the passage of a compensating act. He observed that while the public responds quickly and liberally when several mine workers are killed at one time, it is not disposed to make any provision in the case of individual accidents or when only two or three men are injured together. He expressed his opinion that if such an act were passed, the coal corporations would quickly do their part.

Mr. Davis' lecture was woven around a series of photographs, taken under the supervision of the coal-mining department of the D. L. & W. R.R. Co., and was suggested by the fact that in recent mine inspectors' reports, it has been shown that about 75 per cent. of the inside accidents occurring in the anthracite mines are due to falls of rock or coal at the face, to cars and to premature blasts, where the miner is largely to blame.

Starting at the time when the miner received his safety lamp at the lamp shanty at the head of the shaft, he was followed, in photographs, into the mine and through his day's work. The illustrations showed how many accidents occur and how easily they may be avoided, by the exercise of care. Among the points emphasized by Mr. Davis were the importance of a careful examination of the face before beginning the day's work.

This should be made first with a safety lamp to detect whether gas is present, and then with a naked light to disclose bad roof. The condition of the roof and of the timbers should be examined after a shot, and all loosened material should be removed. If any timbers are displaced, they should be reset before the miner goes to the face to determine the effect of the shot or to begin to load the coal which the shot has dislodged.

A common cause of accident, which is often classed as a "premature blast," is the practice of charging and firing two or more holes at one time, with the chance of one of them delaying fire, and exploding as the miner returns to the face to examine the effects of the shots. Other "premature blasts" are caused by the miner's violating the mine law, which expressly forbids his tampering with the squib, so as to shorten the time, the result being that the miner is caught by the blast before he can reach a place of safety.

When a bit has been used for some time for drilling holes, the gage is apt to become narrow, and the size of cartridge, which formerly fitted the hole is too large in diameter to be placed easily. The common course followed in such a case is to ram the charge into the hole with the drill, the contact of the metal with the rock causing sparks which ignite the powder with disastrous effects.

This can be avoided by providing the firebosses with gages and requiring a regular examination of the bits. All which are defective should be sent to the blacksmith to be expanded before they are again used. Carelessness in the handling of powder or dynamite, or of allowing lights in too close proximity to the box in which powder is kept, or to the place where the cartridge is being prepared, has caused many accidents.

The next injuries and fatalities considered were those caused by cars, both in the face and along haulage roads. In places driven to the dip, a clevis block, placed eight or ten feet from the end of the track, will prevent a car, of which the driver has lost control, from running into the face and crushing the miner.

Some drivers are in the habit of riding in a sitting position on the front bumper of a car, dragging the foot on the rail, and this is a frequent cause of accidents. Others result from the improper placing of props along the track. The mine law requires a clearance of two feet from the body of the car on one or both sides. Many men are injured from runaways resulting from the improper blocking of cars in the face of places driven on a slight pitch.

The next regular meeting of the institute will be held on Saturday evening, Dec. 14.

First Aid Meet at Lexington, Kentucky

Plans are being laid by the coal operators of Kentucky, with a view to holding a state-wide first-aid contest in Lexington, Ky., in May, 1913, at the annual meeting of the Kentucky State Mining Institute. The matter has been given much attention, owing to the recent contests held by the Continental Coal Corporation, Aug. 24, and by the Association of Tennessee Mine Foremen, in Knoxville, Tenn., on Oct. 26. It is hoped to interest every operator in the state and have 100 or more teams to compete.

The program committee is composed of H. D. Easton, chairman, State University, Lexington, Ky., Hywel Davis, president of Kentucky Miners' Association, Louisville, Ky., and W. L. Moss, vice-president and general manager of the Continental Coal Corporation.

Immigration Statistics

The following is a comparative statement of immigration into the United States over the last four years:

	1912	1911	1910	1909
Jan.....	60,791	36,361	50,242	43,869
Feb.....	45,380	42,836	57,982	67,154
March.....	91,185	81,687	136,745	113,038
April.....	99,839	98,036	135,052	116,754
May.....	113,635	95,361	133,544	107,839
June.....	92,425	71,019	105,025	85,470
July.....	78,101	51,737	73,153	66,218
August.....	82,377	50,110	78,574	59,777
Sept.....	105,611	62,599	83,931	69,610
Oct.....	.....	69,418	83,805	75,608
Nov.....	.....	94,955	74,353	85,049
Dec.....	.....	61,626	59,481	68,716
Total....	.....	815,745	1,071,887	957,106

Coal and Coke News

From Our Own Representatives in Various Important Mining Centers

Washington, D. C.

Further suspensions and refusals of higher rates on the transportation of coal by the Interstate Commerce Commission are indicating plainly that that body has not altered its policy of refusing to grant advances in freights. The situation is becoming acute in the judgment of some of the best observers, and politicians who are now coming back to Washington say that they will do their best to get Congress to take some action in regard to the situation that will relieve conditions. Just what they can do is not yet certain, but several courses of action are proposed.

One suggestion is that there should be a resolution proposing and providing for an investigation of freight rates and the financial condition of the railways. The idea would be merely that of giving the Interstate Commerce Commission some notice that there is dissatisfaction with the attitude it has been assuming.

Another suggestion is the adoption of a long resolution reciting the attitude of Congress in regard to higher rates on the roads. The latter plan is not favorably regarded and would hardly be feasible. Something, however, seems certain to be attempted.

Shipments for October

Anthracite shipments for October amounted to 6,665,321 tons. This is the record tonnage for one month, overtopping the previous record of last March by 95,634 tons. The increase over October of 1911 is 396,142 tons. Last month's production from the mines would have been still larger but for the celebration of holidays by the mine workers and the strikes declared at various mines because some of the employees refused to wear union buttons.

The Car Situation

The Interstate Commerce Commission has recently sent out a warning letter to coal-carrying roads and coal shippers, declaring that the car shortage is largely due to the fact that certain roads are refusing to return coal cars belonging to other roads, and are using them to transport other commodities.

Wilkes-Barre, Penn.

Most of the larger anthracite operators have kept their mines working at "full blast," with the exception of the holidays celebrated by miners. Because of the curtailment in production, there has been some dissatisfaction expressed by consumers, who have been under the impression that there has been an artificial storage.

In all cases where coal has sold at a premium over the circular, the advance has come from the independent operators. These mine operators have increased the price and enjoyed a harvest, but the outlook here is that coal will not reach a higher figure than it is now commanding, despite the fact that independent operators are ready to "jump" the price at the first opportunity.

Dissatisfaction with Conciliation Board

General dissatisfaction pervades the anthracite regions and the cause seems to rest in the dislike the men hold for the Conciliation Board. Failure of this body to arrive at decisions on grievances presented for adjudication is the root of the trouble. Among the miners the belief prevails that the operators are using dilatory tactics for the purpose of disrupting the union. The men seem to think that the delay of measures before the Conciliation Board will disgust the converts to the union and result in their finally withdrawing, thus crippling the organization numerically and financially.

Instances are pointed out where grievances have gone to the Board and have been so long delayed that they either solved themselves or were permitted to go by default.

The Miners' Examining Board

The Miners' Examining Board, of Luzerne County, has been censured by a grand jury for passing miner's certificates to foreign-born residents who are unable to speak the English language. Several cases came before the jury, in which it was plain that the men who held such papers could not converse in the Anglo-Saxon tongue. The jurors in their report to the court condemned the practice of granting certificates to such persons.

In order to prevent any fraud in the granting of miner's certificates, the two district boards of this section have decided to hold joint meetings. It has come to light that there have been instances where applicants who failed before one board presented themselves before the other and secured the desired papers. By holding joint meetings, the applicant who is turned down by the board of his district will be unable to appear before that of the other.

Pennsylvania

Anthracite

Wilkes-Barre—One thousand miners and laborers, employed at No. 5 mine of the Lehigh & Wilkes-Barre Coal Co., went on strike, Nov. 2, owing to the employment by the company of nonunion men. A conference has been held with General Superintendent Huber, but no agreement has been reached.

Taylor—A supplemental decision was issued by the Interstate Commerce Commission, Nov. 4, in the case of the Marian Coal Co., against the Delaware, Lackawanna & Western R.R., holding that the rate of $1.13 on rice coal or smaller sizes from Taylor to Hoboken, N. J., or New York Lighterage station, should be reduced to 98c. a long ton.

Wilkes-Barre—J. T. Featherston, fireboss at the Scranton colliery of the Lehigh & Wilkes-Barre Coal Co., was killed Nov. 2, as a result of being crushed by a runaway car. Two other men were seriously hurt.

Hazelton—The 300 outside hands at the Jeddo No. 5 colliery, Messers. G. B. Markle & Co., struck Nov. 5. The reason given is that the carpenters at the breaker and the shop have declined to join the United Mine Workers.

This is the second strike at the Markle operations within a week, breaker boys having tied up another colliery several days ago, but returned to work Nov. 5 on the promise that their grievance is to be adjusted.

Bituminous

Connellsville—Since the West Virginia locomotive fuel coals were shut out of the Pennsylvania coal operators' market by the action of the Interstate Commerce Commission last spring, the competition has been decidedly restricted. As a result, Pennsylvania operators feel that they are approaching the day when their business profit will be sufficiently great to overcome the losses which they feel they have sustained in the past.

West Virginia

Charleston—After being on strike for four months, 3000 coal miners will return to work in the Coal River mining district, within a week, according to a statement made by "Mother" Jones, at the Fleetwood Hotel, Nov. 7.

Several law suits aggregating $750,000 have been filed by Cabin Creek coal operators against individuals of the

United Mine Workers of America. The coal operators allege that the men named defendants used unlawful interference with the operation of the mines, intimidation of miners and destruction of property.

Tennessee

Nashville—The hearing of the complaint of the Traffic Bureau of Nashville against the Louisville & Nashville, the Nashville, Chattanooga & St. Louis, and the Illinois Central R.R., in which overcharges in the transportation of coal is alleged, was begun before Interstate Commerce Commissioner Chas. C. McChord, Nov. 1.

Ohio

Columbus—The Black Diamond Coal Co., with headquarters in Columbus, and mines in Athens County, has insured its 188 employees with the State Liability Board of Awards. The premium paid by the Black Diamond company for six months' insurance amounted to $605.05.

Broadwell—The old engine house of the Big Four coal mine, located here, was recently completely destroyed by fire. Loss, $2000. The mine is a small one. It is managed by Messrs. James, Cassell, Morris & Wells, all local people.

Indiana

Linton—Twenty miners were seriously and many more slightly injured Nov. 4, when a miners' train ran into an open switch at the Shirley Hill mine No. 3. About 300 men were on the train at the time. The cause of the accident is not definitely known except that the miners' train collided with a string of empty cars on the siding, derailing several of the latter.

Indianapolis—Retail coal prices in this city and vicinity are from 25c. to $1 per ton higher now than during the corresponding period last year.

Terre Haute—A delegation of six Indiana and Illinois coal operators left Terre Haute, Nov. 6, for Washington, D. C., to appear before the Interstate Commerce Commission in regard to the car shortage. A protest has been filed with the Illinois and Indiana State Railway Commissions urging the appointment of receivers if the service for which the various roads were incorporated was not fully rendered.

Illinois

Duquoin—It is reported that all of the mines here are seriously handicapped because of inadequate transportation facilities. Operators have orders for hundreds of cars of coal for immediate delivery.

Springfield—Owners, operators and lessees of coal mines near Springfield have filed a petition with the Interstate Commerce Commission asking for a readjustment of freight rates on coal. There are 34 complainants and 53 railroads are named as defendants.

Harrisburg—The O'Gara Coal Co., with offices in Chicago, and operating 16 mines in Saline County, has donated to all the churches of the county their winter's supply of coal, even paying for its delivery.

Colorado

Mt. Rose—Peter Nusbaum, a well known driller, recently opened another flowing well. In this instance he has also located a fine 10-ft. bed of coal. The coal was struck at a depth of 225 feet.

Mr. Hotchkiss, on whose land the coal was found, is considering the proposition of putting down a shaft and developing the coal.

Wyoming

Kemmerer—The Kemmerer Coal Co. is now opening a new mine known as No. 6. Work here at present is of a temporary nature but it is expected that coal shipments will begin soon. The main slope will be sunk on No. 1 and No. 4 seams, which are considered the best coal mined in this district.

Washington

Spokane—"The labor famine in the Northwest has assumed a particularly serious phase in the mining regions of British Columbia, and is liable to be reflected in Spokane in an increase in the price of coal," said Frank Bailey, of Princeton, B. C. "The Princeton Coal Co., from whose mines a large amount of the coal consumed in Spokane comes, is now operating its properties at far less than capacity because of lack of miners, and the superintendent told me a few days ago that he could use at least 50 more men," he continued.

Plans for the American Mining Congress are rapidly taking form, and it is believed that the meeting, which is scheduled for Nov. 25 to 30, will be one of the most interesting meetings ever held. A feature of the congress will be a rally in which old miners will discuss old times. This rally will be known as the "Spokane Diggers."

Canada

MANITOBA

Winnipeg—The coal miners' strike at Belview, Alberta, in which 1400 men went out Oct. 31, was settled Nov. 6 by J. O. Jones, vice-president of the United Mine workers of America, and Ralph Menard, general manager of the West Canadian collieries. The men affected will be reinstated.

The outlook at Fernie, B. C., is still bad. Three thousand men threaten to strike if an arbitration board is not appointed immediately to deal with their grievances.

Personals

D. P. Loomis, of Canton, Ohio, has been made general manager of the Mullin Coal Co., which operates mines in the Beaverdam Valley, in Carroll County.

Edward B. Day, since 1907 advertising manager and vice-president for the Coal Publishing Co., has resigned to become a member of the staff of the *Engineering Magazine*, of New York, N. Y.

James F. Beattie has resigned his position as Division Superintendent of Shawmut Mining Co., at Byrnedale, Penn., and has accepted the position of general superintendent of the Williams Mining Co., at Oak Ridge, Penn.

W. H. E. Royce, formerly general superintendent of the coke operations of the Republic Iron & Steel Co., at Uniontown, has assumed the management of the Connellsville Basin Coke Co., which has 200 ovens at Rock Forge, W. Va.

Henry T. McMillan, district superintendent of the North Pittston district of the Pennsylvania Coal Co., has been promoted to the position of inspector. Mr. McMillan began his mining work on a surveying corps, being gradually raised to foreman and district superintendent, having served as superintendent since 1902. His new district will cover the territory from West Avoca to Forest City, with headquarters at Dunmore. A. E. Yetter has been promoted to fill Mr. McMillan's position as superintendent.

Obituary

Mr. William S. Watson, aged 86 years, died at his home, at Bevier, Mo., on Nov. 4. Mr. Watson was at one time president of the First National Bank, of Macon, and operated large coal mines at this place. He also owned a farm of several hundred acres, and was engaged in the mercantile business. Lately, owing to feeble health, he had retired from active business. Mr. Watson is survived by a widow and six grown children.

Recent Coal and Coke Patents

Improvements in or Relating to the Discharge of Coke from Vertical Gas Retorts. 17,616 of 1912. R. Dempster & Sons, Ltd., Elland, York, & H. J. Toogood, The Poplars, Elland, York, England.

Underframe for Dumping Cars. W. P. Bettendorf, Bettendorf, Iowa. 1,039,638, Sept. 24, 1912. Filed Mar. 5, 1910. Serial No. 547,569.

Smoke Consumer. R. G. Speer, St. Louis, Mo. 1,039,205, Sept. 24, 1912. Filed Dec. 14, 1911. Serial No. 665,780.

Conveyor. W. Graham, New Orleans, La. 1,039,730, Oct. 1, 1912. Filed Oct. 22, 1910. Serial No. 588,532.

Trade Publications

Chain Belt Co., Milwaukee, Wis. Issue of November, 1912. Description of concrete mixers. 8 pp., 6x9 in., ill.

Construction News

Peoria, Ill.—The coal mines along the Kickapoo Creek, in Limestone township, have started increasing their capacity. Most of the mines in that vicinity supply the wagon trade, and for over a week the demand was greater than the output.

Taylorville, Ill.—The Peabody Coal Co. has let the contract for the construction of a power plant in Kincaid to J. H. Woodward, of Chicago. It is to be of brick, 200 ft. long and 100 ft. wide and 50 ft. high. Exclusive of equipment it is to cost $105,000.

Youngstown, Ohio—The Republic Iron & Steel Co. have asked for bids on the construction of 68 byproduct coke ovens near Youngstown. These ovens are to have a daily capacity of 1000 tons of coke and are expected to be completed by December, 1913.

Gainesville, Iowa—It is rumored that new coal developments in this vicinity are probable in the near future. The report says that a certain company, the name of which is not given, will take up the matter of securing a sufficient acreage to justify testing.

Cresson, Penn.—The Pennsylvania Coal & Coke Corporation is planning extensive improvements, and it is expected that the 100 coke ovens now idle in Cresson will be fired not later than Jan. 1. New conveyors, new trestles, and new coke bins will be installed.

Mt. Sterling, Ky.—The Big Staff Coal Co., which has been organized in this city with R. R. Wilson, of Frankfort, as president, and J. Clay Cooper, this city, as secretary, treasurer and general manager, is making preparations to develop the property. It owns 760 acres of coal and timber lands.

Bennington, Penn.—No. 19 mine of the Pennsylvania Coal & Coke Corporation, known as the Bird Eye, will resume operations in the near future after an idleness of a few years. Machinery is being installed and the mines put in order for operation. All of the ovens will be fired and about 100 men employed.

Hastings, Penn.—The Rich Hill Coal Co., Hastings, Penn., is working on developments that will make it one of the most uptodate mines in the state. The improvements provide for the output increase from 600 tons a day to about 3000 tons a day. Electric cutting machines, haulage and power equipment are being installed.

Albion, Mich.—Work on the coal mine near Albion has been retarded, because the shaft which is being sunk has struck quicksand. The shaft is now 35 ft. deep, but the action of the quicksand causes this to cave in around the mouth. The bed of coal which they expect to reach is 4 ft. thick and is said to be a good grade of soft coal.

Gallatzin, Penn.—The 200 ovens of the Pennsylvania Coal & Coke Corporation in this town has been increased by 200 more. Similar increase in the output will soon be made at the Bennington mines of the company, where 50 ovens will be put into service. At Moss Creek 380 ovens will be lighted as soon as plans can be carried out.

Palouse, Wash.—The Palouse Coal & Oil Co., which was formed about a year ago to mine the coal found two years previous near Palouse, Wash., has completed sinking a shaft and the coal is reported to exist in paying quantities. The company is holding a lease on the farm of W. R. Fulton, and they are conducting their work there.

Brownsville, Penn.—Plans are being drawn for the construction of a new coke plant, near Big Meadow Run, which is located on the Monongahela R.R., a few miles south of this place. A company of Pittsburghers are said to have purchased a tract of about 100 acres. T. B. Young, of this place, is the engineer in charge of the preliminary work.

St. John, N. B.—Sir Thomas Tait states that two shafts are now working in his company's mine in Queens County, that a third shaft has just been sunk, and preparations are now under way for putting down another. The coal is of good quality. A number of miners' cottages are nearing completion, and some miners and their families have been brought from Scotland.

Rankin, Ill.—Construction work is in progress on the erection of a 200-ton concrete and steel coaling station for the Lake Erie & Western R.R. This is the first station of concrete and steel design to be undertaken on this road. The work is being carried out under the supervision of Wm. G. Atwood, chief engineer maintenance of way department in Indianapolis.

Ecuador—The contract for the Huigra Cuenca Ry., a proposition which has been before the Ecuadorian Congress for several years, is now about to be signed. The company undertaking this work is American. This railway is about 60 miles in length, and will afford access to the coal fields of Ecuador, which are said to be very rich and from which the country hopes to obtain her coal supply.

Rock Springs, Wyo.—Development work at the property of the Lion Coal Co., at Rock Springs, Wyo., is progressing nicely and shipments are expected to begin about Dec. 1. This mine is located in the heart of the Rock Springs districts and the coal is of standard quality. Modern coal-handling machinery and screening plant is being installed, and it is anticipated an excellent product will be placed on the market.

Victoria, B. C.—The Canadian Pacific Ry. has awarded a contract to Moore & Pethick, of Victoria, for grading 20 miles of the E. & N. extension along the Vancouver Island east coast. The section is between a 10-mile contract being carried out by C. E. Hoard, of Victoria, south from Union Bay, and a 15-mile contract being carried out by Culliton Bros., of Spokane, north from McBride Junction, near Nanaimo; same to be completed July 1, 1913.

Edgewater, Ala.—The most modern coal plant in the South has just been completed by the S. J. Harry Co., Connellsville, for the Tennessee Coal, Iron & R.R. Co., at Edgewater, Ala. The local company's contract included the sinking of the main shaft and the air shaft each 400 ft. deep, a manway 1028 ft. long and approaches to the main shaft were driven through "faults," which necessitated four tunnels through rock formation a distance of 2000 ft. in the aggregate. Cost, $300,000.

Somerset, Penn.—Boswell Coal Co., of this city, of which Thomas C. Boswell is president, has just closed a deal for the acquisition of 600 acres of coal lands located near Somerset, Penn., on the B. & O. R.R., which property was formerly owned by the Smokeless Fuel Co. Plans are now being prepared by the Boswell Co. A few months ago the Bear Run Coal Co., of which Mr. Boswell is president, acquired 2900 acres of coal lands, near Sydney, Indiana County, Penn., and this property is now being improved.

Amsbry, Penn.—The Pennsylvania Coal & Coke Corporation is making preparations to have its two mines at Amsbry operated on a large scale. The mines are equipped for electricity, and power will be secured from the Pennsylvania Central Light & Power Co.

Various repairs are being made about the mines and it is hoped to resume operations within a few weeks. From 50 to 75 men are employed there now and about five cars of coal are shipped every day. With this force of men the output of coal will be greatly increased.

Williamson, W. Va.—Development work on the property of the Pond Creek Coal Co. in Pike County, Ky., is actively under way, openings having been made at several points on the large tract, which the company acquired a year or two ago.

A power house is under construction and 250 miners' houses have been completed. The railroad from Williamson, W. Va., has been graded for the greater part of its length, and track laying has been commenced. Officials of the company expect the rails to be laid to the Nos. 1, 2 and 3 mines by Nov. 15.

Danville, Ill.—A deal has been closed between the Electric Coal Co. and the heirs to the Mason Wright farm for several hundred acres of coal under that farm, which paves the way to a field of coal containing thousands of acres which can be easily obtained. If the roof over the coal proves to be fairly good, then a field has been opened which will furnish work for at least 20 years for the miners of Vermilion County.

It is understood that no new shafts will be sunk, but that the coal will be hauled to the old shaft and hoisted by the same engines that have been used to hoist the past production.

Colorado Springs, Colo.—Negotiations, which have been under way for several months between Colorado Springs capitalists and European capitalists will result in the immediate investment of $1,000,000 in a coal land enterprise, in Jackson County, and the subsequent investment of probably three times that amount. Coal lands of immense value will be developed, and when the proposition is under way, not less than 2,000,000 tons of coal a year will be added to Colorado's output.

Coincident with the coal proposition will be the construction of a new railroad in connection with the Laramie, Hahn's Peak and Pacific road. This will involve an expenditure of probably $3,000,000, and will result in opening up a tremendous tract of land rich in natural resources.

Ridgway, Penn.—The Toby Coal Mining Co. has opened its Black Diamond mine at Ridgway, with a force of 20 men, and considerable coal has already been shipped. The company is advertising for men, and as soon as the mine can be put into shape, employment will be given to 50 or 60 miners and the output increased accordingly.

The mine is located on the West Clarion branch, and its output is being han-

ated by the Erie Co. D. D. Groves, manager of the mine, anticipates a steady winter's run, and the plant will give employment to a large number of men as long as the demand for coal continues. W. P. Harris is the mine foreman.

New Incorporations

Boston, Mass.—Carr Mines Co., Boston and Central City, Colo., capital $100,000.

Trenton, N. J.—The Amalgamated Collieries Co. has been recently incorporated with a capital of $225,000.

Chicago, Ill.—Fayette County Coal Co., $5000; general coal business. Incorporators, L. J. Peraszo, G. F. Cella and T. J. Talbot.

Ashland, Ky.—The Chatfield Coal Co., Ashland, has changed its name to the Kentucky Coal & Coke Co., and increased its capital from $10,000 to $30,000.

Lexington, Ky.—The Southeastern Kentucky Development Co., Lexington, Ky., was incorporated with a capital of $150,000, to develop 32,000 acres of coal and timber land.

Galesburg, Ill.—Anderson Grain & Coal Co., $25,000; deal in grain, produce, building materials, machinery, etc. Incorporators, A. R. Anderson, Edward Lundgren, B. E. Hewitt, C. H. Anderson and F. R. Winger.

Benton, Ill.—Middle Fork Mining Co., Benton, Ill.; capital, $200,000; general coal and coke business; also general merchandise. Incorporators, J. M. Seymour, W. W. McCreery, Robert P. Ward, R. E. Poindexter.

Trenton, Ohio—The Trenton Grain & Coal Co., of Trenton, Ohio, has been incorporated with a capital of $10,000, to deal in coal among other things by Albert F. Babeck, A. F. Augsparger, I. H. Bell, Sol Thomas and R. J. Kennel.

Blocton, Ala.—The Cahaba Central Coal Co. is the name of a recently formed mining company composed of men of West Blocton: Reed & Jones, W. R. Young, Geo. W. Randall and I. B. Krentzman. The "Big Reach Place," about a mile north of town, is the location of the new mine being developed.

Indianapolis, Ind.—The Brown County Development Co., capitalized at $100,000, has recently filed articles of incorporation. The object of the company is to sink shafts for coal and drill for oil and gas in Brown County. The directors are John C. Billheimer, Geo. W. Bruce, William G. Gardner, M. Holloron and H. S. Cone.

Wellsboro, Penn.—Application of the Rock Run Coal Co. for a charter has been granted. The company intends to mine coal on properties located along Rock Run. Capital, $70,000. Incorporators, C. H. McCauley, Fred A. Midgely and M. T. Dean, all of Williamsport; John A. Vandergrift, of Wellsboro, and Scott Jenkins, of Blossburg.

Industrial News

Udell, Penn.—The Marion Coal & Coke Co., whose plant is at Udell, has purchased the Ruff farm, west of Armbrust. About 75 miners will be employed.

Connellsville, Penn.—Idle coke ovens in the Connellsville district are rapidly being fired. During the past week 200 additional ovens resumed operations.

Monongahela, Penn.—Coal boated to market from the Monongahela River mines during the month of October attained the high mark of 17,734,000 bushels.

Mulberry, Kan.—The Sheridan Coal Co. has contracted for the sinking of three new shafts near the Frisco line, north of Mulberry. It is expected that these shafts will be completed in about three months.

Spring Canyon, Utah—The Knight coal property in Spring Canyon, Utah, expects to be shipping in the near future. This coal is similar to the other Utah coals and resembles the Castle Gate coal of the Utah Fuel Co.

Springfield, Ill.—The Spalding Coal Co. mine, the tipple of which burned last May, expected to resume work on or about Nov. 4. The tipple is of steel construction, and of equal capacity with the one destroyed.

Benton, Ill.—North Mine No. 1, of the Ziegler District Colliery Co., made a record hoist, Nov. 4, of 3032 tons in 8 hours. This is the record for Franklin County. W. S. Watts is superintendent and H. H. Gamber, engineer.

Leipsig, Ohio—The Nickel Plate coal docks at Leipsig were destroyed by fire Nov. 6. These docks were built about five or six years ago and were of modern construction. It is expected that they will be rebuilt at once.

Gallup, N. M.—The Victor American Fuel Co. is opening a new slope near the old Clarkville mine, about seven miles west of this city. The coal business is booming, and the mines are working overtime, when they can get the cars.

Des Moines, Iowa—Iowa mines are running at full blast, and the daily output of coal is totaling close to 50,000 tons. The only mines which are not running under full headway are those which are suffering from car shortages.

Hannanstown, Penn.—The Jamison Coal & Coke Co. has opened a new tract of coal on the west side of their mine here and is working it by a night shift. In the near future they intend to install electric haulage in place of the compressed-air haulage now in use.

Taylorville, Ill.—Extensive test drilling work in and about Taylorville on the options of Lewis Overholt has been completed, a total of 18 test holes being sunk. Although but little can be learned from the drillers, it is the general belief that a good deposit of coal was discovered.

Corey, Ala.—The Tennessee Coal, Iron & R.R. Co. are heating up the last of the four batteries of 70 Koppers by-product coke ovens, preparatory to firing the same. This completes the plant of 280 ovens started about two years ago. They are located at Corey, about six miles from Birmingham.

Litchfield, Ill.—Interest in coal rights in this country has received added impetus within the last few days, and soon diamond drills will be used in making tests on the different coal fields in this locality. Land owners in all parts of the country are awaiting the results of the present test with much interest.

Cleveland, Ohio—The Industrial Car Co. has changed its name to the Electric Locomotive & Car Co. to emphasize its electrical work. This branch of the work is in charge of J. P. Copeland.

There has been no change in the ownership or officers of the company, and it will continue its other line of work as heretofore.

Philadelphia, Penn.—The Bureau of Mines after trying out a number of Hirsch electric mine lamps at the Pittsburgh testing station have recently placed five different orders for similar apparatus to be used at various stations and rescue cars. The Lehigh Coal & Navigation Co. have also placed a repeat order for 1000 of these outfits.

Amesville, Ohio—Federal Valley mines, or rather the mines in the valley, are shipping from 30 to 50 cars of coal each day, and still the work of opening the new mines goes on as rapidly as possible. The large tract of coal lately opened by William Job, Jr., has been sold and a large force of men are laying a switch from the railroad to the farm of E. H. Glazier, near Broadwell, where the opening will be made.

Hillsboro, Ill.—The Clover Leaf Coal Mining Co.'s mine here was closed down Nov. 30, by State Mine Inspector W. W. Williams. The reason assigned for the action is the condition of the air shaft and escapement. Aside from this, the mine is said to be in first-class condition.

It is reported that a new air shaft is to be sunk and the company can then obtain a permit to operate the mine.

Boulder, Colo.—One of the largest deals for electricity ever made in the state was closed in Oct. 29, when the Rocky Mountain Fuel Co. signed a contract with the Northern Colorado Power Co. to use 3200 horsepower-hours per month in its 12 mines in Boulder and Wells Counties.

The steam plant, with which the company has been operating its properties, will be replaced as rapidly as possible by electric-power machinery.

Springfield, Ill.—F. L. Thompson, engineer of bridges and buildings for the Illinois Central R.R. Co., has just awarded a contract to the Roberts & Schaefer Co., engineers and contractors, Chicago, for the building of a large Holmen Counterbalanced Bucket Locomotive Coaling Station, for supplying locomotives with coal, at Springfield, Ill.

This is the second plant of this type that this company has built for the Illinois Central, the first having been put in commission last year at Carbondale, Ill. Approximate price, $10,000.

Pittsburgh, Penn.—The Pittsburgh & Lake Erie cutoff between Fuller and Fayette City, which was completed and put in operation a couple of months ago, is now handling considerable coke from the Klondyke or Lower Connellsville region for transfer to the Western Maryland at Connellsville.

The Pittsburgh Coal Co. owns most of the undeveloped coal along this cutoff, and the management of this company is considering the advisability of putting in two new operations, but as yet no definite movement has been made in this direction.

Denver, Colo.—Capitalists, who recently sought a long lease on a section of state coal land in Jackson County from the State Land Board, now have reached the conclusion that the conditions imposed by the Board were such that they have decided to drop the project. It is understood that the capitalists' main objection to signing the lease offered was to the terms of the clause by which the state required the company to guarantee improvements.

The company, however, will operate in the same field in which the state section of coal land is located, and has taken possession of 160 acres of private land.

Coal Trade Reviews

Current Prices of Coal and Coke and Market Conditions in the Important Centers

General Review

The month of October saw the heaviest production of anthracite in the history of the industry, but it has not brought any tangible evidence of relief. Anxiety on the part of dealers and consumers becomes more apparent as the season advances, and it will not be long before all available supplies are cleaned up.

In the coastwise bituminous trade, detention at Hampton Roads is becoming more serious, and dealers are losing hopes of obtaining adequate shipments; the all-rail movement is slow and irregular. However, transportation is much better than at any time during the past two or three weeks, and operators have, consequently, come nearer meeting their agreements than for some time. Buyers in the Pittsburgh district are beginning an active campaign for contracts, and the market will be well established shortly; there is practically no spot market, as companies are all behind on their contracts, and no free coal is available in any quantities.

The recent cold snap in Ohio has stiffened the market, but there is a noticeably better movement on the railroads which has tended to relieve the situation some. The general tone is strong in every particular, especially in domestic, and the mines are working from 30 to 50 or 60 per cent. capacity, which is better than for some weeks. At Hampton Roads there is a pronounced scarcity of coal, and operators are all short on their contracts. In the South, domestic shippers are getting further behind and it is believed that a famine is developing; prompt delivery is now regarded as more important than quality.

In the Middle West the anticipated break has failed to materialize and the market remains firm. Orders are far in excess of the supply, and it is believed that this condition will prevail for some time. The resumption of work at the copper mines in the Far West has caused a return of the car shortage and a hardening of the situation there.

Boston, Mass.

The bituminous market is strong but with no significant change either way. Detention on Pocahontas and New River at Hampton Roads grows more serious and some dealers here are losing hope of any adequate shipments from that quarter. On the higher grades from Pennsylvania there is little offering and prices are firm.

Water freights are off on account of the slow loading and the slim outlook for anything like normal shipments at tidewater. The top rate is now 80c. on large vessels, Hampton Roads to Boston. All-rail, both bituminous and anthracite, the movement is slow and irregular.

The anxiety over anthracite increases as the season goes on. Retail deliveries are getting larger and it will take only a short time to wipe out present supplies. Company coal at current prices has been portioned out along the lines recognized in the trade but it is impossible to satisfy. Premium coal is still being received at or around $7.50 alongside, or $1.75 above the net circular for stove and egg.

Current quotations are about as follows:

Clearfields, f.o.b. mine	$1.40@1.75
Clearfields, f.o.b. Philadelphia	2.65@3.00
Somersets, Cambrias, f.o.b. mine	1.55@1.85
Somersets, Cambrias, f.o.b. Philadelphia	2.80@3.10
Pocahontas, New River f.o.b. Hampton Roads	3.25@3.50
Pocahontas, New River on cars Providence	4.25@4.35
Pocahontas, New River on cars Boston	4.45@4.65

New York

Bituminous—The mild weather at this point is helping to quiet the demand and the threatened stringency of a few weeks ago has not as yet materialized. The supplies at tidewater have been picking up some, and there are now fair stocks on hand. There has been quite a heavy movement into New York and vicinity, and the car supply has been fairly good, although the required kind of equipment cannot always be had.

There is a strong steady demand that absorbs all the tonnages coming in and eliminates the accumulation of any substantial surpluses. Prices have not experienced any further advance, but are ruling firm at the same high level of the past few weeks as follows:

West Virginia, steam	$2.95@3.05
Ordinary grades, Pennsylvania	2.95@3.05
Fair grades, Pennsylvania	2.95@3.05
Good grades, Pennsylvania	3.10@3.15
Best Miller, Pennsylvania	3.15@3.25
Georges Creek	3.50

Anthracite—A uniform advance of 25c. a ton on the prepared sizes went into effect in the retail trade on Monday of this week. The large companies still maintain their regular circular and the increase is due to the fact that many of the local wholesalers have been obliged to purchase premium coal from the independent operators in order to meet their obligations.

The car supply continues good, but the hard-coal roads report that foreign lines are slow about returning equipment. Work at the collieries is still being interrupted by petty strikes. Steam sizes, which have been moving rather slow for the past few weeks, became more active during the early part of the current week.

Quotations continue about as follows:

	Upper Ports	Lower Ports
Broken	$5.00	$4.95 @ 5.75
Egg	5.25	5.20 @ 6.85
Stove	5.25	5.20 @ 6.85
Nut	5.50	5.45 @ 6.85
Pea	3.50	3.35 @ 3.75
Buckwheat	2.75	2.25 @ 2.45
Rice	2.25	1.85
Barley	1.75	1.95

Pittsburgh, Penn.

Bituminous—Car supply is about the same as a week ago. In most sections there is a slight improvement, but at the opening of the week the supply on the Monongahela division of the Pennsylvania was only about 50 per cent., although owing to the weekly cleanup the supply on Monday is expected to be particularly good. Lake shipments will be pushed somewhat later than was expected, and many of the mines will continue to ship up to Dec. 1, mostly for consignments up the lakes, although some coal will probably go into vessel storage.

There is practically no open market for prompt coal, there being scarcely any Pittsburgh district coal sold, shippers being generally behind in their contracts. A lot of five carloads of slack was sold a few days ago at $1.15, but $1.25 would likely be the asking price should any develop. The Pittsburgh Coal Co. last week issued a letter of instructions to its agents naming prices on contracts for next year of $1.30 on mine-run and nut, $1.40 on ¾-in., $1.55 on 1¼-in., and 90c. on slack. About three weeks earlier the Pittsburgh-Buffalo Co. issued a circular at $1.25 for mine-run and nut, $1.35 on ¾-in., $1.50 on 1¼-in. and 90c. on slack, and this company, with perhaps one or two others, is adhering to this basis. This week most of the sellers begin an active

canvass for contracts and the real market is likely to be made within a fortnight. For the current year the circular prices were $1.22½ on mine-run and nut, $1.32½ on ¾-in., $1.47½ on 1¼-in. and 82½c. on slack, but these quotations were very generally—and generously—shaded. At present quotations operators will, as a rule, sell only for the full calendar year.

Connellsville Coke—The market remains very strong, prompt furnace coke bringing $4 without difficulty and occasionally a slightly higher figure. The supply continues very restricted, and while only a few furnaces are willing to pay $4, there is always enough demand to take up the small amount of prompt coke offered. Nothing has been done lately on contracts for first half. The bulk of the business was done some time ago, and the small amount of unsold coke remaining is being held for high prices, $3.50 being named by a number of sellers. This the market will not pay today, but the operators are quite content to wait. It is possible that $3 could be secured. We quote the market approximately as follows: Prompt furnace, $4@4.25; contract furnace, $3@3.25; prompt foundry, $4.25@4.50; contract foundry, $3.25@3.50.

Philadelphia, Penn.

Notwithstanding the fact that there was more anthracite coal produced during the month of October than ever before in the history of the trade, the dealers in this vicinity say that their receipts have shown no indication that such was the case. Continual urging by the jobbers has only resulted in their obtaining a small proportion of their requirements. From all sections of the city comes the same tale about the lack of coal and it has now reached a stage where the solicitors are loth to call on their trade.

Opinions seem to differ as to the amount of premium coal that is being disposed of. The large companies are not deviating from the circular, and the individual operators are sticking by their old trade and delivering coal on the same basis. It is only in case of new customers that the individual operators are likely to apply the higher prices, which is perhaps more in the nature of an indication that the business is not particularly desired. Of course, considerable premium coal is being sold, but when compared with the large tonnages constantly moving, the percentage is small.

Responsibility for the shortage is still being saddled on the anthracite companies. It is doubtful if any of the companies have one pound of the domestic sizes in stock. The present output is being sent to the market, and the demand early in the season completely absorbed all the coal that was carried over from last winter. Talk about a coal famine in this section of the country, however, is out of all reason.

The bituminous market is not exactly holding its own. A better supply of cars has caused a slight softening in the scale of prices. While there is a large tonnage moving, coal is not quite so hard to get, and as a consequence, prices have eased off somewhat from the quotations of a month ago. Taking the market in general, it indicates a healthy condition, which is likely to improve as the winter advances, providing, of course, the car shortage does not enter into the situation.

Baltimore, Md.

An improvement in the car situation took place during the past week, much to the gratification of the local trade. The betterment was particularly noticeable on the Baltimore & Ohio, and operators shipping over that system, came nearer to making their contract deliveries than they have been able to for weeks past. About the middle of the week, the roads lifted the embargo placed on their equipment about ten days ago and toward the last part of the week, they claimed they were furnishing all the equipment demanded by the operators. The situation on the Western Maryland is also better than it has been for some time, and the movement from mines in West Virginia to tidewater was freer.

Free coal is practically unobtainable in the local market, every ton mined is moving under contract and the companies are refusing new business. One operator made the statement that he would not take any additional orders, no matter what prices were offered.

The high-price level for all kinds of coal is still being maintained; low grades are quoted around $1.60. The coke market also remains firm.

Buffalo, N. Y.

There is some report of a weaker bituminous market, but it is not apparent here. If the mines could work up to full capacity there would soon be a surplus, but so long as a great part of the shippers, especially on the Pennsylvania lines, are constantly short of cars there is not likely to be too much coal.

Some members of the trade are beginning to discount the time of the closing of Lake navigation next month, but there have been plenty of seasons when that readjustment in the car movement had but small effect on the market and if they remain as scarce as they are now the expected slump will not be very pronounced. At the same time there is not much prospect of prices going higher. Some are of the opinion that they have advanced too far already and if that proves to be true there will be some reduction, but it will not amount to much if business continues brisk.

It is still difficult to quote bituminous prices, as the Pittsburgh district is often making quotations that are not expected to be accepted. Sales have been made at $3.15 for Pittsburgh lump, $3 for three-quarter, $2.85 for mine-run and $2.45 for slack, with Allegheny Valley about 25c. lower. Coke is as strong as ever at $6.50 for best Connellsville foundry. The supply is short, and there is a report that it is not again likely to be excessive because so many of the mines tributary to the ovens are worked out.

The anthracite market is as strong as ever and the mines are refusing to take any more orders, as so much has already been sold ahead. The fine weather has been especially favorable to shippers, who dread the prospective cold snaps this month. Lake shipments for the week were only 115,500 tons, little or nothing having been done on election day.

Hampton Roads, Va.

The past week has been a tiresome one for Hampton Roads shippers. With the possible exception of one or two, all are short of coal. The pronounced scarcity has discouraged any desire on the part of shippers here to take advantage of the high prices being offered by consumers who failed to cover their needs by contract. As a result all coal now coming into Hampton Roads is applied on the contract business, which while not attractive now, must nevertheless be protected.

The enforced idleness in the New River and Pocahontas districts, due to the election, will likely be felt throughout the balance of the season. Since Nov. 1 the miners, who took an unusual interest in the election, have put in little time digging coal.

At Hampton Roads on yesterday vessels were on hand awaiting either coal or berth for approximately 100,000 tons of coal. Altogether the situation has very much the appearance it had during the strike period last Spring. The rates on coal-carrying vessels this week have weakened somewhat, due probably to the scarcity of tonnage.

Columbus, Ohio

While a recent cold snap had the effect of stiffening the coal trade, still there was a slightly better car supply which relieved the situation to a small extent. But the general tone of the market is strong in every particular and everyone is clamoring for coal. The domestic trade is probably the best, but there is also a good demand for the steam grades and railroad fuel.

Prices are ruling firm, and every change is toward higher levels. Dealers are trying to stock up, but every effort in that direction has met with failure because of the poor car supply. Their stocks are light, and, in many cases, they

are compelled to apportion their supply among customers instead of filling the larger orders.

The steam trade is still strong, and manufacturing establishments are buying in the open market at premium prices. Factories have been unable to stock ahead to any great extent, and as a result are only running from hand to mouth as it were.

Production in most of the Ohio fields shows a small increase over the previous week. The car supply on the Hocking Valley R.R. was some better, and, as a result, the Hocking field reported from 50 to 60 per cent. of normal, which is quite an increase over the previous week. In the Pomeroy Bend district, conditions were still bad and the output is estimated at 35 per cent. In the other fields, including eastern Ohio, the production was about 30 to 35 per cent. of the average.

Traffic officials, as well as the Ohio Public Service Commission, are making every effort possible to relieve the car situation. Their efforts have not met with much success up to date, but may in the future. Railroads are confiscating coal cargoes for use on their locomotives.

Quotations in Ohio fields are:

	Hocking	Pittsburgh	Pomeroy	Kanawha
Domestic lump	$2.25		$2.35	$2.25
2-in.	2.00	$1.60	2.00	2.00
Nut	1.75		2.00	
Mine-run	1.75	1.50	1.75	1.75
Nut, pea and slack	1.15		1.25	1.00
Coarse slack	1.05	1.25	1.00	0.90

Birmingham, Ala.

Shippers of domestic coal are getting further behind on deliveries, and as winter approaches it becomes more evident that a coal famine will develop in the South as soon as the present stocks are exausted. The situation in this district is made more serious on account of the shortage of anthracite in the cities along the coast, thereby causing that trade to draw heavier than usual upon the local mines. There is no domestic coal obtainable for nearby shipment, as practically every mine is behind on deliveries, because of the car shortage. The price of spot steam coal is gradually advancing and prompt delivery is a greater consideration than quality.

The coke market is feverish. The price of foundry coke has reached the highest mark since 1907 and is still advancing. Nut coke for domestic purposes is in good demand, especially among the trade heretofore supplied from the anthracite field.

Louisville, Ky.

The past week has seen practically no change in the car situation, and consequently local stocks are reported to be running alarmingly low. From 40 to 50 per cent. of the requirements of the operators are being supplied by the railroads, and there seems to be no possibility of getting enough cars for a full day's output, except now and then for railroad coal. Owing to this condition, and to the fact that Western Kentucky operators are still considerably behind with summer orders, there is practically none of their coal quoted for sale at the mines. The producers naturally have no desire to take new contracts when they are unable to get shipping facilities to fill those already several months old. The same conditions obtain in eastern Kentucky and Tennessee.

Steam coal seems to be especially scarce. As most of this grade is delivered to the customer's switch in cars, it is impracticable to accumulate any stock, as the cost of rehandling would be prohibitive.

Quotations, as far as they can be had, are about as follows: Eastern Kentucky block, $2.50@2.75; lump, $2.10@2.25; round $1.85@2; nut and slack, 60@90c., with little available, some companies refusing to quote any figures.

Chicago

The anticipated break in prices has failed to develop and the local market remains firm. Orders are still in excess of the supply and it is believed this condition will continue for some time.

Householders and retailers are obtaining a short supply of anthracite and, as a result, have entered the market for Pocahontas, southern Illinois coal and coke. The supply of smokeless coal is less than normal. The mines have not been able to ship much more than 45 per cent. of their productive capacity. Smokeless mine-run is now selling at $1.40@1.50, the mines, and prices remain sensitive to any big demand. Lump and egg command $2.75@3, f.o.b. the mines, for Chicago delivery.

There has been a jump of about 5c. a ton in the price of screenings on account of increased activity among industrial concerns. The demand for coke continues heavy.

We quote the Chicago market:

	Sullivan Co.	Springfield	Clinton	West Va.
4-in. lump	$2.87			
Domestic lump		$2.82	$2.77	
Egg	2.87			$4.40
Steam lump		2.12	2.27	
Mine-run	2.32@2.42	1.97	2.17	3.45
Screenings	1.62@1.67	1.52	1.52	

Coke—Prices asked for coke are: Connellsville, $6.25@6.50; Wise county, $6.25@6.50; byproduct, egg and stove, $5.75@6; byproduct, nut, $5.75@6; gas house, $5.75@6.

Detroit, Mich.

At the present time there seems to be plenty spot coal here but the coal operators are predicting that this city is facing a shortage that will tie up many important industries this winter if relief is not found shortly. They have appealed to the Interstate Commerce Commission to persuade the coal railroads to raise their embargo. A report is current that the B. & O. and C. & O. have complied with this appeal, but are not making the necessary allotments at the different mines along their lines. The market still continues firm. The prevailing prices are as follows:

	W.Va. Splint	Gas	Pocahontas	Hocking	Jackson Hill
Domestic lump and egg	1.70		2.75	1.75	2.75
¾ lump	1.60	1.60		1.50	
Mine-run	1.50	1.50	1.75	1.55	
Slack	1.00	1.00	1.50	1.25	

Anthracite—There is no change whatever in the hard-coal market. Prices continue at $2.50 above circular and a very limited supply is coming to this market.

Coke—This product is becoming exhausted rapidly, and contracts are not being filled as they should be. Several large orders were placed with the different coke operators but were returned on account of inability to take care of same. Prices remain at the same level as those quoted last week.

St. Louis, Mo.

The St. Louis coal market at present is almost at a standstill. There seems to be no decline in the price of high-grade coal, but the dealers and consumers are not buying as recklessly as they have. The prevailing prices for the better grades are not any different from last week's, with the exception of No. 1 nut, which has fallen off 10 or 15c. per ton. Standard coals are moving very slowly, and prices are not as good as they were last week. In several instances 2-in Standard lump sold as low as $1 at the mines, which is about as low as it has been any time during the summer and fall.

Anthracite shipments are not any better than they have been at any time this year, and prospects are not very bright for anything better before the first of the year at least. Coke is in excellent demand and extremely hard to get in any tonnages.

The prevailing prices are:

Carterville	
6-in. lump	$2.00@2.15
3x6 egg	1.85@2.00
No. 1 nut	1.50@1.60
Screenings	0.75@0.85
Mine-run	1.20@1.30
No. 1 washed	2.10@2.25
No. 2 washed	1.60@1.75
No. 3 washed	1.35@1.40
No. 4 washed	1.15@1.35
No. 5 washed	0.75@0.90
Murphysboro Big Muddy	
Lump and egg	$2.35
Trenton Sootless	
Lump and egg	$2.40
Mount Olive	
6-in. lump	$1.75
3-in. lump	1.50
2-in. lump	1.40
Screenings	0.50
Standard	
6-in. lump	$1.30@1.40
2-in. lump	1.05@1.15
Screenings	0.30@0.35

Odgen, Utah

The car shortage still continues in both Wyoming and Utah. Mines are making strenuous efforts to load all available cars and get them in transit while the mild weather prevails. Most of the companies are still shipping on back orders and have a long list yet to be filled. Prices for all grades remain firm, but at present there is no indication of an immediate advance.

While the sugar factories have drawn heavily on their surplus supply of coal, they are not in immediate danger, due to the slow delivery of beets. This has been occasioned by continued rains in the beet-growing districts.

The miners strike at Bingham, Utah, and Ely, Nev., which caused cessation of operations at both camps during October, has now been adjusted and both districts are gradually working back to normal condition. At the beginning of the strike all coal orders were cancelled, and this threw a large tonnage on the market, but as the Utah miners were far behind in their shipments, at the time, it was of great assistance to them to have this surplus to apply on other contracts. Not only was the coal available, but a large number of cars, that were formerly retained in the coal and ore service, were placed at the mines for shipment to other points.

On Nov. 1, Wyoming, Utah and New Mexico fuels advanced in California and are now quoted: Lump, $3.50; nut, $3; mine run, $1.85, f.o.b. the mines. The supply of foreign coal is diminishing and few cargoes are arriving, due to the high water rate. This has stimulated the demand for rail coal and all shippers report active operation in this territory.

General quotations are as follows:

	Wyoming	Utah
Lump	$2.75	$2.75
Nut	2.25	2.25
Mine-run	1.85	1.85
Slack	1.00	1.25

Portland, Ore.

The car shortage and labor troubles in the various mining districts is causing coal dealers here considerable annoyance. Some difficulty is now experienced in getting coal from the old established mines in the state of Washington on account of the heavy demand from other markets. Values remain unchanged here and dealers do not see any indication of a change in the near future. No coal is coming here from Australia this fall.

Production and Transportation Statistics

Anthracite Shipments

The following is a comparative statement of anthracite shipments for October, 1911-12, and the totals for the first ten months of the current year, in long tons:

	1912	1911	10 Mos.
Phila. & Reading	1,434,923	1,273,412	10,385,395
Lehigh Valley	1,217,297	1,109,170	9,505,104
Cent. R. R. N. J.	938,297	913,048	6,769,128
Del. Lack. & West.	970,139	880,699	7,325,085
Del. & Hudson	589,717	604,722	5,126,694
Pennsylvania	547,061	570,930	4,495,080
Erie	756,452	730,984	6,059,536
Ont. & Western	211,435	186,214	1,834,518
Total	6,665,321	6,269,179	51,500,540
10 Months, 1911			57,645,558

Production in October, the largest ever reported in any one month, was somewhat higher than the trade estimate, being at the rate of nearly 80,000,000 tons per year. All companies except D. & H. and Pennsylvania increased their output over the very heavy shipments in October of last year. The month was favorable to mining and the mines were worked regularly though not at full capacity. There were several holidays and car scarcity kept down production a little. The result indicates that the present colliery capacity is something above 7,000,000 tons monthly.

Chesapeake & Ohio Ry.

The following is a comparative statement of the coal and coke traffic over the lines of the C. & O. Ry., for September, 1911, and for the three months ending Sept. 30, 1911-12, in short tons:

		Three months	
Destination	September	1911	1912
Tidewater	282,244	982,627	927,233
East	189,388	483,955	554,352
West	756,803	2,947,109	2,663,989
Total	1,228,435	4,413,691	4,145,574
Coke	20,058	55,519	62,116
From Connections			
Bituminous	19,070	56,581	55,690
Anthracite	1,195	9,579	2,792

Virginian Railway

Total shipments of coal over this road for September of the current year were 276,851 net tons, as compared with 337,366 for the month previous.

Foreign Markets

Great Britain

Nov. 1—Prices are very irregular for spot loading, owing to inadequate tonnage supplies, but sellers are holding for firmer values for forward delivery. Prices are approximately:

Best Welsh Steams	$4.08
Best Seconds	3.96
Seconds	3.78
Best Dry Coals	4.08
Best Monmouthshire	3.66
Seconds	3.48
Best Cardiff Smalls	2.52
Seconds	2.46

The prices for Cardiff coals are f.o.b. Cardiff, Penarth, or Barry, while those for Monmouthshire descriptions are f.o.b. Newport, both exclusive of wharfage, and for cash in 30 days—less 2½%.

German Empire

The production, imports and exports of the German Empire for the first eight months of this year were as follows, in metric tons:

	Production	Imports	Exports
Coal	116,395,324	6,394,713	20,554,655
Lignite	52,880,655	.....	.....
Coke	18,688,125	389,345	3,696,057
Briquettes	15,834,316	.....	.....

Financial Notes

The following table gives the range of various active coal securities and dividends paid during the week ending Nov. 9:

Stocks

Company	High	Low	Last
American Coal Products	95	95	95
American Coal Prod. Pref.	111	111	111
Col. Fuel & Iron	38½	35½	38½
Consolidation Coal of Md.	103¾	103¾	103¾
Island Creek Coal	60	57	58½
Lehigh Valley Coal Sales	260	250	
Pittsburg Coal	25	22⅝	23½
Pittsburg Coal Pref.	94	92	92
Pond Creek	28⅜	24⅜	27¼
Reading	174⅛	169⅝	171⅛
Reading 1st. Pref	88	88	88
Reading 2nd. Pref.	97	96	96
Virginia Iron C. & C	65½	65	65½

Bonds

Company	Closing Bid	Asked	Weeks Range or Last Sale
Colo. F. & I. gen. s f g 5s	98¾	100	98¾ Sept. '12
Colo. F. & I. gen. 6s	108	108½	107¼ June '12
Col. Ind. 1st & coll. 5s. gu.	83	85	84¼ 84¼
Cons. Ind. Coal Me. 1st 5s.	....	84	85 June '11
Cons. Coal 1st and ref. 5s.	....	94	93 Oct. '12
Gr. Riv. Coal & C. 1st g 6s.	95	100	102½ Apr. '06
K. & H. C. & Co. 1st s f g 5s.	98	....	98 Oct. '12
Pocah. Con. Coll. 1st. s f 5s.	85	88	87¾ 87¼
Tenn. Coal gen. 5s	101⅜	101½	101½ 101½
Birm. Div. 1st consol. 6s.	102	102½	103½ Sept. '12
Tenn. Div. 1st g 6s	102	102½	102½ Oct. '12
Cah. C. M. Co. 1st g 6s.	103½	110	110 Jan. '09
Utah Fuel 1st g 5s	....	....	....
Victor Fuel 1st s f 5s	....	85¾	85¾ Oct. '12
Va. I. Coal & Coke 1st g 5s.	96	97½	97 97½

No important dividends were declared during the week.

Colorado Fuel & Iron Co.—On sales of 250 shares of preferred stock of this company recently, the price experienced a perpendicular jump of 22 points. Of the $2,000,000 outstanding preferred, it is thought that most of this is well centered in the hands of the Rockefeller interests and the recent transactions were considered "inside buying."

Great Lakes Coal Co. (Pittsburgh)—In response to a bill of complaint by a creditor and stockholder of this concern, a receiver has been appointed for it. The company has $5,000,000 outstanding stock and owns 22,000 acres of coal in Armstrong and Butler Counties, on which there are four mines fully equipped. In addition, it owns the entire capital stock ($1,511,000) of the Western Allegheny R.R., operating 57 miles of railroad built at a cost of $2,600,000.

The Alabama Consolidated Coal & Iron Co.—This corporation has an outstanding capital of $3,750,000. Against all its property there are three sets of bonds outstanding aggregating $9,000,000. Interest on the first series was defaulted during July to the extent of $41,950. The Baltimore Trust Co. holds promissory notes of the Coal and Iron Company aggregating $330,000, but has been restrained by the Maryland courts from disposing of $1,250,000 worth of bonds held as collateral.

Cumberland Coal Corporation—In the new financial readjustment of this concern it will own $10,000,000 preferred stock and all the common stock ($25,000,000) of the Clinchfield Ry., the stock of the Holston Corporation having assets of over $600,000, and will have approximately $950,000 other assets. It is contemplated that the $5,000,000 collateral notes of the Cumberland Corporation will be acquired by the sale of the $5,000,000 of preferred stock of the railway now held as collateral for those notes. This will leave $1,500,000 of the Clinchfield Coal Corporation notes to be retired out of other assets of the Cumberland Corporation.

Throwing The Searchlight On Advertising

Little Talks on a Big Subject for Coal Age Readers

By the Ad. Editor

"A man who never does any more than he is paid for;

Never gets paid for any more than he does."

If you haven't heard this before, it will be well for you to repeat it until you know it, and remember it.

There's a moral in these words.

Imagine a man, if you can, with a pair of balancing scales trying to make the services he is rendering his employer (on one side of the scales) balance the dollars he is receiving from his employer (on the other side).

Such a man will have to do this balancing "stunt" but once, for it's a "cinch," with him, that the dollar side of the scales will never get any heavier.

Money is the most valuable tangible thing in the world.

And money is never exchanged for *anything* except when that thing is considered by the owner of the money to be of more value to him than the *amount* of money he exchanges for it.

This law of exchange applies to other things, as well.

What you exchange, whether it's money or not, is *never* exchanged for anything which you consider of *less* value to *you* than what you offer the other fellow.

Now, your services are for sale. The mine operator wants to buy your services. He gives you a job. He gets your services. You get his money in return.

Both of you get the better of the exchange, or it would not have been made.

You are benefited by the exchange because you get money in return—the most valuable tangible thing we know.

Your employer is likewise benefited by the exchange because he, through your services, gets what you get—money.

It's what we all are striving for. We and you will always want more money. It's human nature. And the only way for you to get more money is to make *more valuable* what you give in exchange for the money you get.

Render your employer a *maximum* service, always. Then you increase the *value* of your services. Then, the *value* of the exchange, and consequently a bigger return.

Of course, there are many ways in which you can and are increasing the value of your services to the mine owner.

For a long time, we have been telling you how much real good you can get out of Coal Age advertising.

The advertisers in this paper have a service to render or they would not be in the paper.

They are offering you something that will mean a money saving investment at your mine.

Don't be skeptical. Don't be prejudiced. Don't allow yourself to feel that you are doing all you are being paid for.

But make *your* mine a *better* one. Investigate the claims of these advertisers and their products. Be sure that you have minimized those small wastes which creep into the best and most carefully guarded plants.

Get all you can out of Coal Age advertisers. Investigate their wares. Give them a chance. You've got nothing to lose, at least, by investigating.

You *can* better conditions in your plant—It's not impossible at *any* mine. You can render your employer and yourself a better service.

Don't measure what you do by what you get. Increase the value of your services and the chance for an increased salary will automatically take care of itself.

The selling section of Coal Age offers one way. Get all you can out of it now.

It pays to advertise only because it pays to buy advertised goods